# Windy Boy WB 2500 / 3000
# Inverter for Wind Energy Power Plants

User Manual | Version 1.2 | WB25_30-11:FE0407
TBE-WB25-30

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# 1 Explanation of Symbols Used

To ensure optimum use of this document, note the following explanation of the symbols used.

This symbol identifies an example.

*This symbol indicates a notice where failure to follow the advice will make the procedure or operation more difficult.*

**This symbol indicates a fact which, if not observed, could result in damage to components or represent a danger to persons. Read these passages especially carefully.**

# 2 Introduction

**The Windy Boy may only be installed by trained specialists. The installer must be approved by the local energy supplier. Carefully read this installation manual. All prescribed safety regulations, the technical connection requirements of the local energy supplier and all other applicable regulations must be adhered to.**

The Windy Boy inverters make it possible to operate small wind turbine systems connected to the grid. Grid-connected means that the energy generated by the wind energy system can be fed directly into an existing domestic grid, a stand-alone grid, or the public grid.

To this end, the Windy Boy converts the rectified DC voltage from permanent magnet wind turbine generators, which varies with speed, into grid-compatible AC voltage. Thus, the Windy Boy implies that mains grid voltage is always present!

The Windy Boy complies with all the VDEW (Verband der Elektrizitätswirtschaft – German Electricity Industry Association) regulations for the parallel operation of power-generating systems on the low-voltage grid of the electricity supply company. This also encompasses the regulations of the German Professional Association for Precision Engineering and Electrotechnology relating to the "automatic disconnection device for power-generating systems" (SMA grid guard 2) and/or DIN VDE 0126. In addition to this, the Windy Boy complies with the electromagnetic tolerance regulations and the low-voltage regulations of the relevant combined European standards, as confirmed in the CE declaration of conformity (10.3 "Declaration of Conformity (CE)" (Page 74)).

This part of the device's documentation primarily covers all topics relevant when operating Windy Boy inverters. In addition to explanations of the operational methods of the device and detailed technical data, advice as to data acquisition and analysis is also provided.

Information relating to the installation and commissioning of the Windy Boy should be taken from the installation manual delivered with the device. The Windy Boy inverter has a special operating mode for wind turbines which allows performance adjustment to the characteristic curve of the generator. In this way you can obtain maximum yields from your wind energy system.

A wide input voltage range, very high efficiency and a freely configurable output characteristic curve with the highest level of reliability are only some of the properties that are useful for your grid-connected system, or a stand-alone system combined with the Sunny Island.

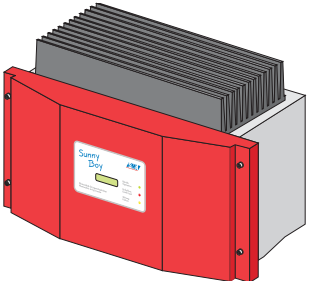
The Windy Boy is compatible with all SMA communication products (RS232, RS485, Powerline, radio, display), providing numerous possibilities for diagnostics, data visualization and remote maintenance of your small wind energy system.

*For stand-alone systems which use Sunny Island: Configure your Windy Boy according to the specifications in the Sunny Island manual.*

*Configuration of the Windy Boy's programmable voltage/power curve with respect to your wind turbine: In order to guarantee optimal operation of your Windy Boy in conjunction with your wind turbine, specific parameters must be adjusted to achieve optimum yields. The configuration process is described in section 6 "Turbine Operation" (Page 31).*

Apart from the parameter settings, the Windy Boy is identical to the Sunny Boy photovoltaic inverter and can therefore also be used as a PV inverter. Download the Sunny Boy manual from www.SMA.de if you are planning to use the Windy Boy in a photovoltaic system, and contact the SMA Hotline.

# 3 Safety Instructions



**Opening of the device, and any**

- **electrical installation,**
- **repair or**
- **modification**

**of the Windy Boy may only be performed by a qualified electrician. Even when no external voltage is present, the device can still contain high voltages.**

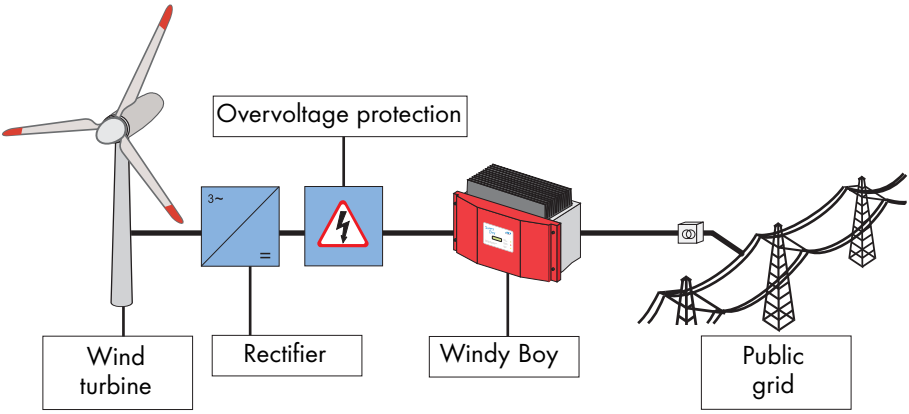
**The temperature of individual parts of the Windy Boy's housing, in particular the temperature of the heatsink, can exceed 60 °C during normal operation. There is a danger of burn injury when these parts are touched!**

*The Windy Boy is equipped with the SMA grid guard 2. This is a type of automatic disconnection device. It ensures that the Windy Boy complies with the VDEW (Verband der Elektrizitätswirtschaft – German Electricity Industry Association) regulations for the operation of power-generating systems in parallel to the low-voltage grid of the electricity supply company and with DIN VDE 0126-1-1, which forms a part of these regulations.*

# 4 Unit Description

## 4.1 Appropriate Usage of the Windy Boy

The Windy Boy is designed for the conversion of rectified DC voltage from a wind turbine (permanent magnet generator) into alternating current for feeding into the public grid. The technical data is described in more detail in section 9 "Technical Data" (Page 51).




Many wind turbine system manufacturers offer an extra overvoltage protection module. This component prevents the destruction of the downstream Windy Boy in the event of overvoltage.

Overvoltages can occur under the following conditions:

- High turbine rotation speeds under strong wind conditions.
- An increase in turbine rotation speed caused by load-shedding when the Windy Boy is disconnected from the grid, e.g. in the event of grid faults or power outages.

The overvoltage protection system has the following tasks:

- When a pre-defined voltage is reached, the Windy Boy is disconnected from the generator and a short-circuit slows the generator and/or brings it to a standstill.
- Some devices reduce the turbine rotation speed, and thus the generator output voltage, by switching on a resistor (dumpload). The electrical energy generated by the turbine is then converted to heat.

In grid-connected systems, we recommend the use of one of the electronic protection mechanisms described here. Note that overvoltage at the Windy Boy can lead to destruction of the device. In addition to this, you lose the right to all warranty claims - even if the maximum input voltage of the Windy Boy is only exceeded for a short time.

The electronic protection system described here is always preferable to mechanical solutions (pitch control, "turning out of the wind").

Any other use of the Windy Boy voids the warranty.

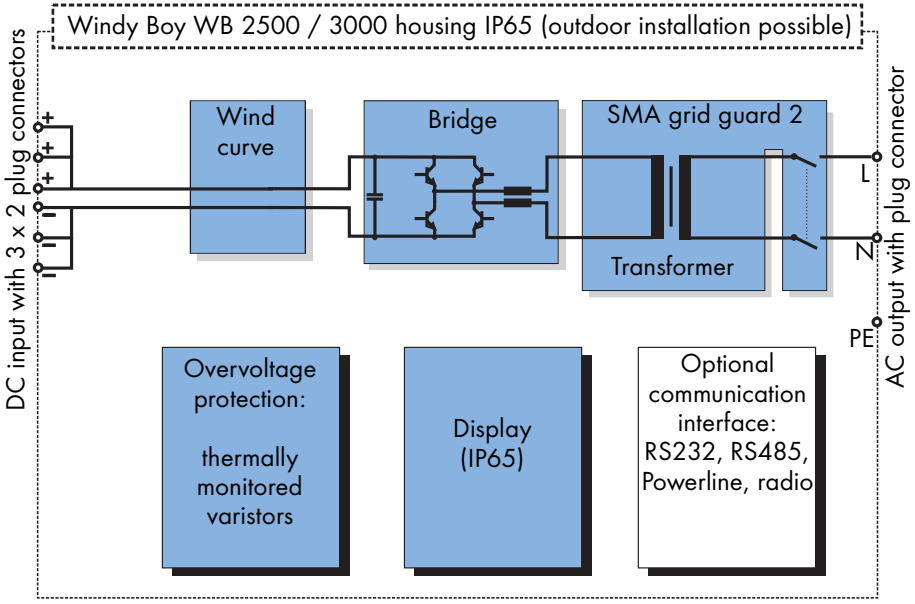
**In the event of overvoltage, immediately disconnect the Windy Boy's DC input! The presence of excessive input voltage can lead to irreparable damage!**

*When the Windy Boy receives an excessive DC input voltage, it automatically disconnects from the grid and ceases its power feeding activity. When the Windy Boy is in operation, you must always first disconnect the AC voltage (grid voltage) and only then should you disconnect the DC voltage from the Windy Boy!*

## 4.2 Structure of the Device

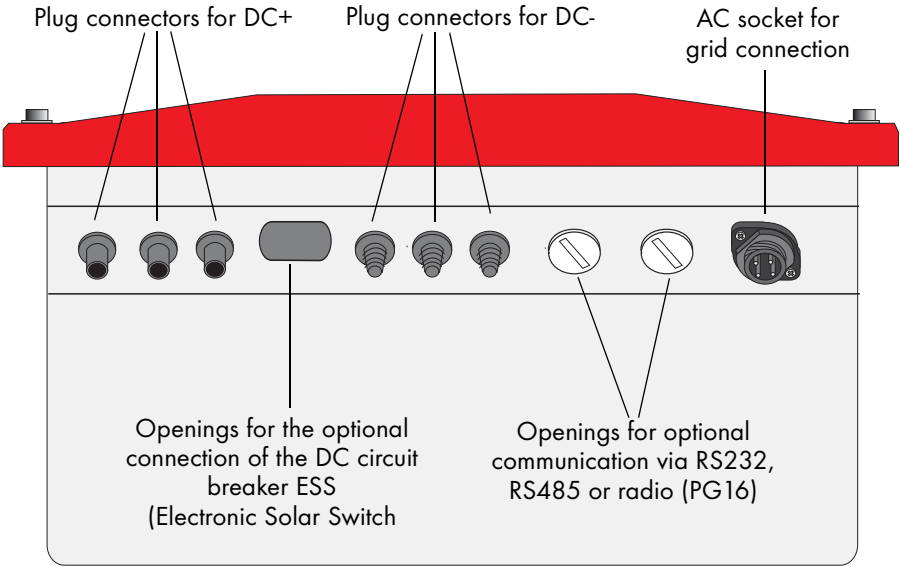
An attractive, functional design is one of the major design objectives of the entire Windy Boy product range. In its basic configuration, the Windy Boy has the proven status display consisting of three LEDs, as well as a plain text display.

As long as it is installed and commissioned according to the technical specifications, the Windy Boy can be operated without any further modification or configuration. The device parameters can however be modified, if required.



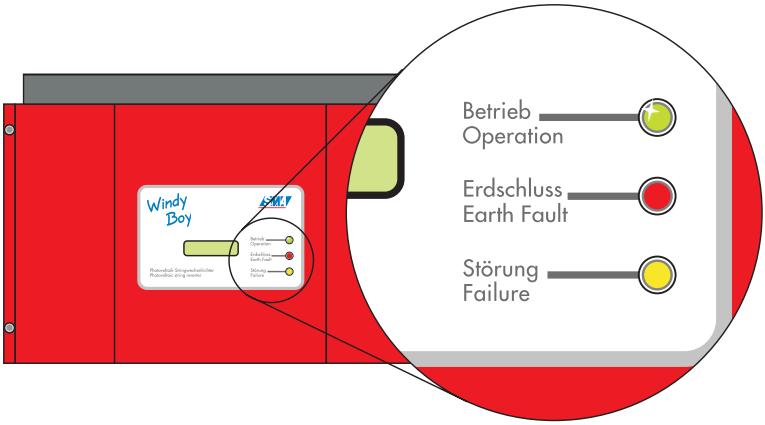

**An extra communication interface is required for ideal adaptation of the Windy Boy to suit the particular wind turbine being used, and this can also be used for querying operational data. For further details, see section 8 "Extensions" (Page 43).**

All DC connections and connections for the public grid, as well as any optional communication connections are to be found on the underside of the Windy Boy. The respective DC connections for + and - are connected in parallel inside the Windy Boy .



## 4.3 Operating Modes

The various operating modes are displayed using three light-emitting diodes (LEDs) on the housing cover of the Windy Boy. To allow the device to indicate its operating mode via the integrated LEDs, the Windy Boy must be connected on the DC side. There must be enough wind energy present, so that the Windy Boy has adequate DC voltage.




*Especially in the first year of operation, the operator of the system should regularly check this display under different wind speeds.*

A complete description of the possible displays can be found in section 4.3.4 "Description of the Operating Modes" (Page 17). These can be split into three categories:

### 4.3.1 Normal Operation

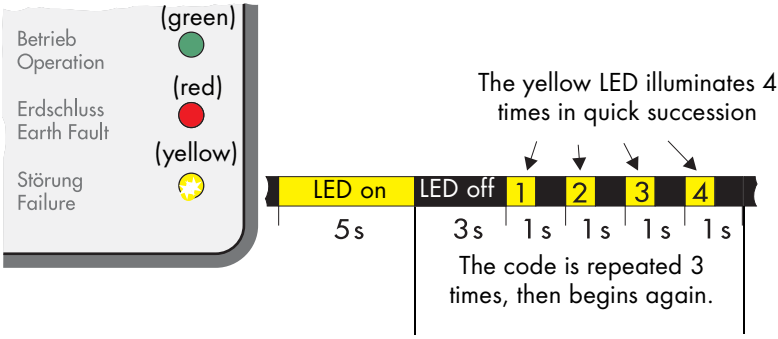
If no LED, or only the green control LED is on, or blinking, the inverter is operating normally. The simultaneous illumination of all three LEDs is also an indication of normal operation ("initialization"). All other displays are a sign of abnormal operation.

## 4.3.2 Critical Faulty Operation

A comprehensive safety concept has limited the number of critical conditions that can occur to one single situation:

Input voltage exceeds the permitted value!

This is indicated by the following blink code on the yellow LED:




The yellow fault LED illuminates for 5 seconds when this fault occurs, then begins displaying the blink code of: 3 seconds off, then 4 times briefly on. This code is displayed 3 times in succession. If the fault is still present, the fault display starts again from the beginning.

**The presence of excessive input voltage can lead to irreparable damage! Immediately disconnect the Windy Boy's DC input.**

*When the Windy Boy receives an excessive DC input voltage, it automatically disconnects from the grid and ceases its power feeding activity. When the Windy Boy is in operation, you must always first disconnect the AC voltage (grid voltage) and only then should you disconnect the DC voltage from the Windy Boy!*

## 4.3.3 Non-Critical Faulty Operation

All other display codes indicate some form of error condition, which is not usually dangerous to people or equipment, but which should nevertheless be investigated and corrected without delay.

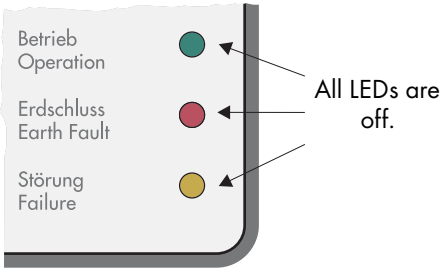
Despite all precautions, it is possible that other errors may occur which cannot be displayed (e.g. failure of the status display). In order to recognize such errors, the operator of the system should use the explanations in section 4.3.4 "Description of the Operating Modes" (Page 17) to check the plausibility of the displayed normal operating modes.

Far more detailed diagnostics are possible using the communication options detailed in section 8 "Extensions" (Page 43) .

## 4.3.4 Description of the Operating Modes

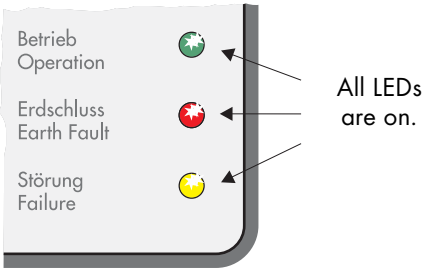
### No (or Low) Input Voltage

The Windy Boy is in the so-called Standby mode. This mode occurs when the input power at the Windy Boy is too low for feeding the grid and for satisfying the on-board power requirements.




### Initialization

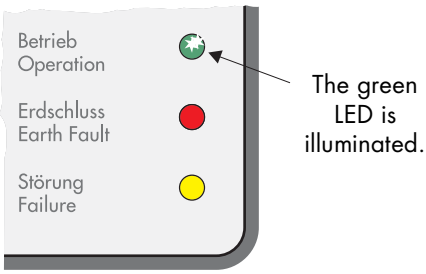
The Windy Boy's on-board computer is at present in the initialization phase. Power for the on-board power supply is present, but output power is not yet sufficient for grid feeding or for data transfer.



## Working Mode

The Windy Boy has successfully passed the measurement electronics and SMA grid guard self-tests and has begun feed-in operation.

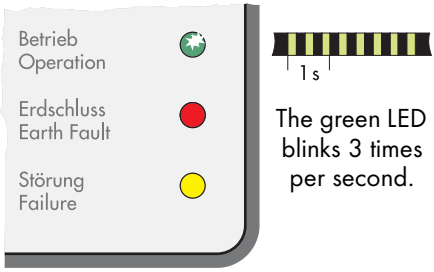
The Windy Boy is working normally and is feeding electricity into the grid. It processes the wind turbine system's DC voltage according to the programmable voltage/power curve (see section 6 "Turbine Operation" (Page 31)).




## Stop

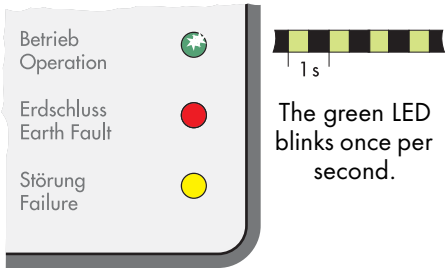
The Windy Boy is in Stop mode. Among other functions, the measurement electronics are calibrated, then the device switches to "Waiting" mode.

The "Stop" mode can also be manually set by the system operator via the Sunny Boy Control or the Sunny Data PC program. In this case, the Windy Boy remains in "Stop" mode until a new operating mode (e.g. "Turbine mode") has been set.



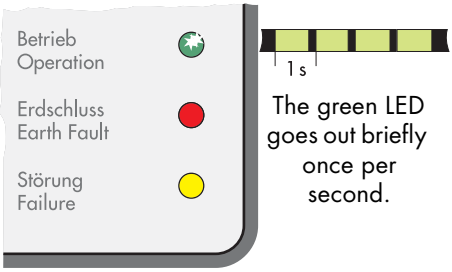

## Waiting, Grid Monitoring

The Windy Boy checks if the initial conditions necessary for grid feeding are satisfied (e.g. start voltage), then begins monitoring the grid.



## Derating

The temperature monitoring of the Windy Boy has reduced the output power to prevent the device from overheating. If this occurs often, this is an indication of inadequate heat dissipation or excessive input current.




- Temperature derating

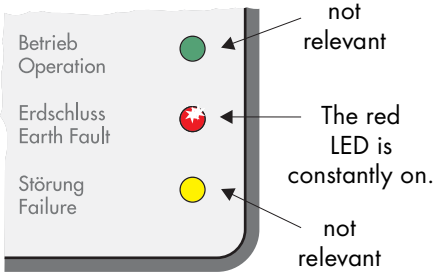
  To avoid unnecessary reductions in yield, in this case it should be checked if the Windy Boy can be mounted in a more favorable position with better ventilation.

- Current derating

  The input current on the DC side exceeds the maximum possible input current. The Windy Boy switches to the "Current Derating" mode in order to protect itself against overload. Check the system layout.

## Defective Varistor or Isolation Error

The red LED on the Windy Boy is constantly on. A grounding error has occurred, or one of the thermally monitored varistors on the DC input side is defective as a result of overvoltage.

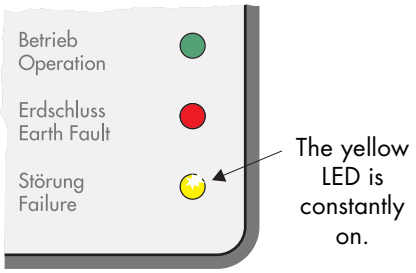



**Consult a trained electrician to correct the fault using the installation manual.**

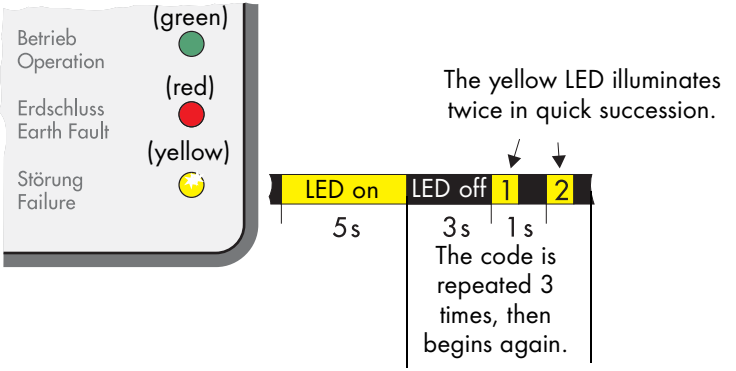
## Permanent Disable

In the event of a recurring fault, the Windy Boy switches to "Permanent Disable" mode, and ceases grid feeding.

A fault may exist that cannot be resolved on-site. You can attempt to correct the error with the aid of a communication interface and the corresponding communication product (e.g. PC with Sunny Data or Sunny Boy Control). If this is unsuccessful, consult the Sunny Boy hotline (section 12 "Contact" (Page 81)) to discuss further action to solve the problem.



## Grid Fault




The yellow fault LED illuminates for 5 seconds when the fault occurs, and then begins displaying the blink code of: 3 seconds off, then twice briefly on. This code is displayed 3 times in succession. If the fault is still present, the fault display starts again from the beginning.

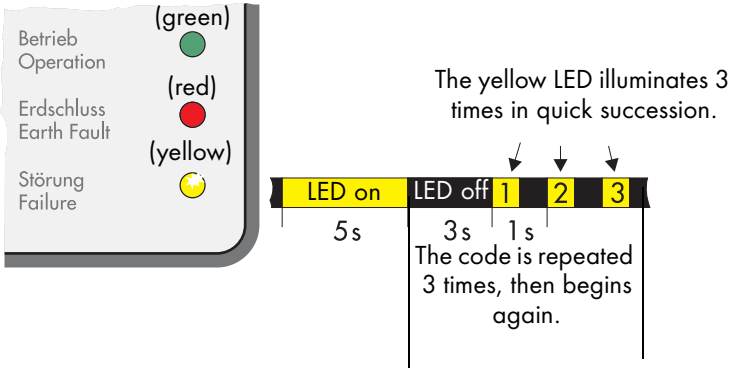
With this message, the Windy Boy indicates a grid fault, which can have the following causes:

- Grid undervoltage ($U_{AC}$ < "Uac-Min")
- Grid overvoltage ($U_{AC}$ > "Uac-Max")
- Grid underfrequency ($f_{AC}$ < "Fac-Min")
- Grid overfrequency ($f_{AC}$ > "Fac-Max")
- Grid frequency change ("dFac").

Check if a general grid dropout has occurred (check the operation of other electrical consumer devices), and check if the fuse of the Windy Boy's feed-in connection is intact.

**If none of these faults can be found, then the Windy Boy's grid connection must be checked by a qualified electrician.**

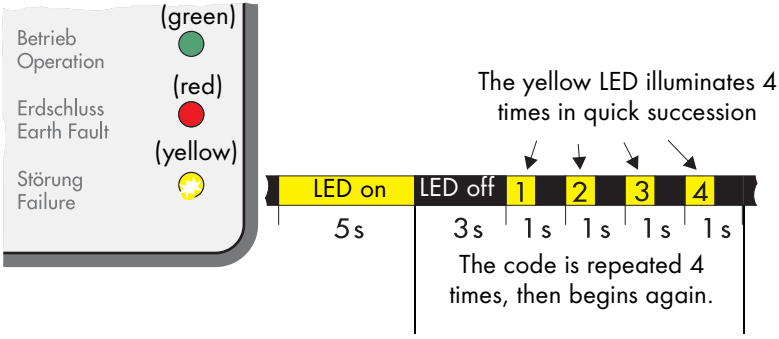
## Excessive Grid Impedance




The yellow fault LED illuminates for 5 seconds when the fault occurs, and then begins displaying the blink code of: 3 seconds off, then 3 times briefly on. This code is displayed 3 times in succession. If the fault is still present, the fault display starts again from the beginning.

The Windy Boy has detected a fault relating to an unacceptable grid impedance. If the Windy Boy frequently deactivates and displays this error during grid monitoring, the cause can be an excessive grid impedance. A qualified electrician can usually assist with this problem by increasing the cross-section of the grid connection cable. Other measures can be taken to correct this fault, but they require the explicit agreement and cooperation of the grid operator.

## Excessive Input Voltage

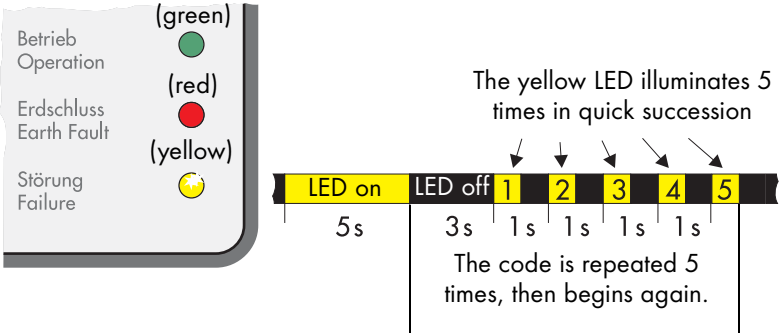



The yellow fault LED illuminates for 5 seconds when the fault occurs, then begins displaying the blink code of: 3 seconds off, then 4 times briefly on. This code is displayed 3 times in succession. If the fault is still present, the fault display starts again from the beginning.

**Immediately disconnect the Windy Boy's DC input. The presence of excessive input voltage can lead to irreparable damage! Make sure that the input voltage never exceeds 60 V.**

*When the Windy Boy receives an excessive DC input voltage, it automatically disconnects from the grid and ceases its power feeding activity. When the Windy Boy is in operation, you must always first disconnect the AC voltage (grid voltage) and only then should you disconnect the DC voltage from the Windy Boy!*

## Device Fault

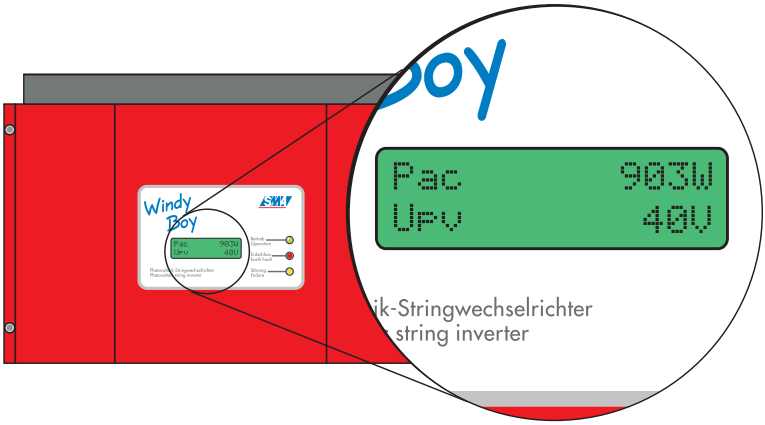



The yellow fault LED illuminates for 5 seconds when the fault occurs, then begins displaying the blink code of: 3 seconds off, then 5 times briefly on. This code is displayed 3 times in succession. If the fault is still present, the fault display starts again from the beginning.

**If the device fault leads to a major impairment of normal operation, the Windy Boy and the entire system installation should be checked by a qualified electrician.**

## 4.4 Information on the Display

Since 2006, the Windy Boy has been equipped with an LCD display in the housing cover as standard.




### Activating the Display Illumination

The background illumination is switched on by tapping on the housing cover. Tapping again switches the display to the next message.

After 2 minutes, the illumination switches off automatically.

### Display Messages in the Startup Phase

The following messages are displayed during the Windy Boy's startup phase. Since the Windy Boy is identical to the Sunny Boy (apart from the operating mode), the display shows "Sunny Boy".

SB1100LV
WR6K-003

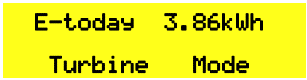
After 6 seconds, the firmware versions of the operation control unit (BFR) and the current control unit (SRR) are displayed.

BFR Version 2.52
SRR Version 2.49

## Display Messages During Operation

The display shows the Windy Boy's most important operating data in a continuous cycle. The following three screen images serve to clarify the display messages. Each message is displayed for 5 seconds. Then the cycle begins again.

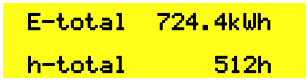
The energy generated today and the current operating mode are displayed first.




*The amount of energy shown under "E-today" does not necessarily reflect the amount of energy produced over the last 24 hours. This is rather the energy produced by the Windy Boy since the last deactivation / activation.*

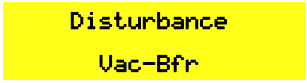
Subsequently, the present feed-in power and the output voltage are displayed.

This is then followed by the total energy produced so far and the operational hours of the device.




## Fault Displays

If an operational fault occurs, the display immediately switches to "Disturbance" and the background illumination is switched on.




The cause of the fault is displayed for 5 seconds in the second line of the display.

If a measured value is responsible for the fault condition, then the value measured at the time of the fault is displayed. If another measurement is possible, the present value is displayed in the second line.

After another 5 seconds, normal operating data is again displayed.

If the fault is still present, the fault display starts again from the beginning. An overview of the status and error messages can be found in section 10.2 "Error Messages" (Page 70) of this document.

"Error ROM" indicates that the Windy Boy has detected an error in the EEPROM firmware. Contact SMA to have the error corrected.

## Special Display Message Upon Excessive DC Input Voltage

If an excessive DC input voltage is present at the Windy Boy, this is indicated by rapid blinking of the background illumination and the message shown here to the right.

**Immediately disconnect the Windy Boy's DC input. The presence of excessive input voltage can lead to irreparable damage! Make sure that the input voltage never exceeds 600 V.**

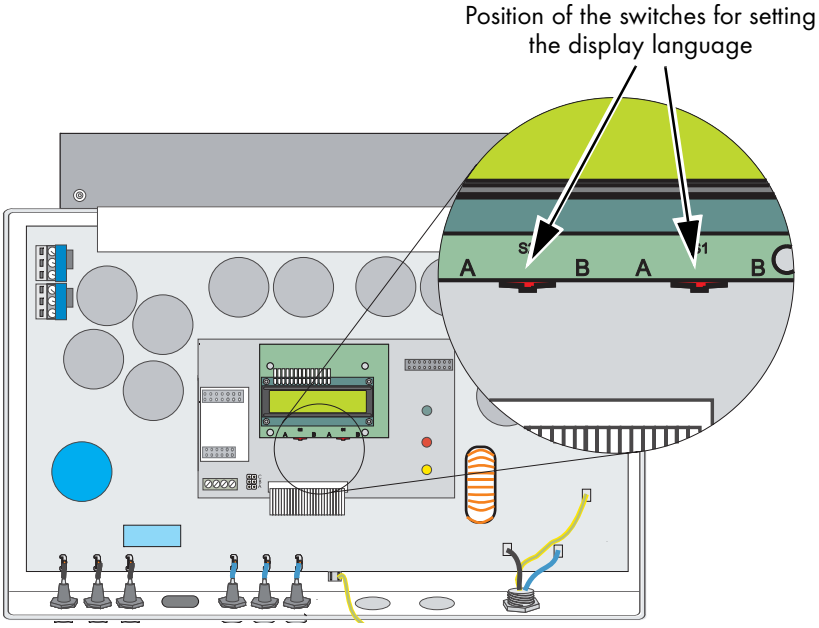
*When the Windy Boy receives an excessive DC input voltage, it automatically disconnects from the grid and ceases its power feeding activity. When the Windy Boy is in operation, you must always first disconnect the AC voltage (grid voltage) and only then should you disconnect the DC voltage from the Windy Boy.*

*Before resuming operation, the input voltage must be checked before reconnecting the DC voltage to the Windy Boy! Since the Windy Boy is identical to the Sunny Boy (apart from the operating mode), the display shows "PV" (photovoltaic) as the input source.*

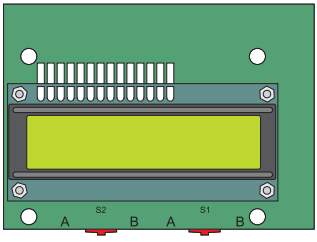
# 5 Setting the Display Language

The display language is set using the switches on the underside of the LCD assembly.

**As the cover must be removed, ask a qualified electrician to disconnect the DC and AC connections from the Windy Boy, according to the installation manual.**




| Language | Switch S2 | Switch S1 |
|---|---|---|
| German | B | B |
| English | B | A |
| French | A | B |
| Spanish | A | A |



# 6 Turbine Operation

## 6.1 Overview

The Windy Boy is a single phase inverter that converts DC current into AC current and feeds the energy generated by a wind turbine system into an existing grid.

The Windy Boy is externally identical to the Sunny Boy inverter for photovoltaic systems.

The Windy Boy does, however, have a special operating mode for wind turbine systems and water turbines, which makes it possible to adjust the output to the characteristic curves of many different manufacturers' wind turbines ("Turbine" operating mode). In this way maximum yields can be obtained from your wind turbine system.

The mechanical power output of the wind turbine is fed into the Windy Boy in the form of a rectified, rotation-speed-variable DC voltage (RPM) and current intensity (torque).

Most small wind turbine systems have a so-called permanent magnet generator and a downstream rectifier for converting the variable-frequency AC voltage from the generator into DC current.

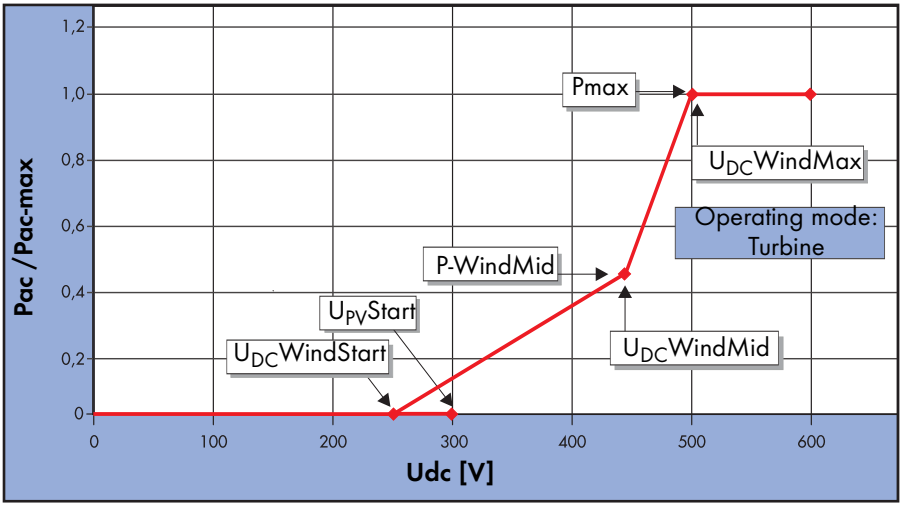
## 6.2 Characteristic Curve Function

The "Turbine" operating mode of the Windy Boy uses a programmable power/voltage curve to regulate the input current depending on the generator voltage.

One characteristic of a wind turbine system, is that it provides an optimum working point for current and voltage corresponding to the present rotation speed or wind speed. This behavior is not linear.

The Windy Boy uses an approximation based on a combination of even functions. These functions can be programmed by the user so that they correspond to the behavior of the wind turbine being used, thus enabling a power adjustment.

The diagram shows the combined even function of a typical Windy Boy power/voltage curve. The feed-in AC power is shown here in relation to the Windy Boy's DC input voltage. The adjustable parameters $U_{PV}$Start, $U_{DC}$WindStart, $U_{DC}$WindMid, P-WindMid, $U_{DC}$WindMax and Pmax can be used to adapt the power/voltage curve of the Windy Boy to the wind turbine being used.




In order to guarantee optimal operation of your Windy Boy in conjunction with your wind turbine, specific parameters must be adjusted to achieve optimum yields.

The Windy Boy also has a smooth startup parameter <P-Wind-Ramp>, which, when activated, protects the mechanical components of your wind turbine system, and thus contributes to a long service life for your system.

Additional adjustments are possible by means of optimizing the Windy Boy's maximum output according to the turbine used, adjusting the control speed and setting activation and deactivation times (<T-Stop>, <T-Start>).

The description of the Windy Boy's operating parameters and the definition of the range of possible settings (factory settings) can be found in section 10.1.2 "Windy Boy Operating Parameters" (Page 61).

An example alteration of operating parameters is described in section 6.4 "General Example Settings" (Page 35).

*To perform the configuration process, the DC input voltage must be greater than <UpvStart> and the Windy Boy must be connected to the grid voltage.*

# 6.3 Characteristic Curve Operation in "Turbine" Mode

*Note: The characteristic curve of the Windy Boy only approximates the actual characteristics of a real wind turbine. Consult the manufacturer of your wind turbine for the typical characteristics of your turbine before changing the characteristic curve parameters.*

## Startup Procedure

During the startup phase, the wind turbine is almost idle. At this stage, the Windy Boy only needs power for the on-board power requirements. If these requirements are met, this operating mode is indicated by all three of the light-emitting diodes (LEDs) on the housing cover illuminating simultaneously.

As soon as the DC input voltage defined in the parameter <UpvStart> is reached, the Windy Boy begins a number of self-tests, measurement processes and synchronization with the grid. This operating mode is indicated by means of the green LED blinking.

If the self-tests are successfully completed, and the DC input voltage remains above the value defined in <UpvStart> for the time defined in <T-Start>, the Windy Boy connects to the grid. This operating mode is indicated by means of the green LED remaining lit.

The inverter also then switches to characteristic curve operation, and regulates the input current according to the generator voltage. The power level defined by the turbine curve is thus fed into the grid. This operating mode is indicated by means of the green LED remaining lit.

Here, it is to be noted that upon switching to characteristic curve operation, the wind turbine is subjected to a corresponding load, i.e. the rotation speed and the DC input voltage decrease. The level of the voltage drop depends on the wind turbine used.

## Characteristic Curve Operation

As soon as the DC input voltage reaches the value defined in <UdcWindStart>, the Windy Boy begins feeding power into the grid. As you can see from the characteristic curve, the power fed into the grid rises with the DC input voltage (curve section I). It is also possible to set <UdcWindStart> lower than <UpvStart>. Thus, grid feeding is also possible with low DC input voltages. However, this setting depends on the voltage level of the grid.

As soon as the DC input voltage reaches the value defined by the parameter <UdcWindMid>, the output power corresponds to the value defined by <P-Wind-Mid>. If the voltage continues to increase, the power rises according to the voltage/power curve. To emulate the typical behavior of an actual wind turbine system, after <P-WindMid> the curve is steeper than before <P-WindMid>.

As soon as the DC input voltage reaches the value defined in the parameter <UdcWindMax>, the Windy Boy feeds the grid with the maximum possible power. If the input voltage continues to rise, the Windy Boy continues to feed the grid at maximum power. The maximum output power corresponds to the maximum AC output of the Windy Boy, but can be reduced via the parameter <Pmax>.

The characteristic curve ends at the maximum permissible DC input voltage of the Windy Boy, which must never be exceeded.

## Shutdown Procedure

If the wind strength is so low that the DC input voltage falls below <Umin> (an internally calculated minimum level for operation), then the Windy Boy operates without feeding power into the grid for the period defined in <T-Stop>.

If the DC input voltage increases once more, the <T-Stop> timer is deactivated, and the Windy Boy resumes according to the defined curve operation.

If the DC input voltage remains beneath <Umin> for the period defined by <T-Stop>, the Windy Boy switches itself off.

If the DC input voltage no longer suffices for powering the on-board electronics, the Windy Boy deactivates immediately.

After the switch-off process, the whole process starts from the beginning.

*Only change the operating parameters if you know exactly what you are doing!*

## 6.4 General Example Settings

Note that the following example only represents a starting point for operation with a wind turbine.

- **<UpvStart>** is set approximately 20 % lower than the lower limit of the Windy Boy's MPP range:
  - This results in early activation of the Windy Boy.
- **<UdcWindStart>** is set to the lower limit of the Windy Boy's MPP range:
- This results in early grid feeding.
- **<P-Wind-Mid>** is set to approximately 1/5 of the Windy Boy's maximum AC power.
- **<UdcWindMid>** is set in the upper third of the voltage range between <UdcWindStart> and <UdcWindMax>. The selection of this point divides the curve into a weak and a strong wind range, and is decisive for optimal adjustment of output according to your wind turbine. It is to be noted that the curve is flat in the weak wind range, and climbs more steeply in the strong wind range. The flat curve in the weak wind range prevents the wind turbine from "braking" due to excessive power extraction, and thus provides good startup properties.
- The steeper curve section causes a strong increase in power extraction upon higher DC input voltages. This behavior corresponds to typical wind turbine properties.
- **<UdcWindMax>** is initially set approximately 10 % below the Windy Boy's maximum MPP voltage:

  Once the properties of the wind turbine are known, reduction of the <UdcWindMax> parameter may be advisable, in order to extract the maximum power from the wind turbine even at low DC input voltages (low wind speeds). The second curve section then increases more steeply.
- **<Pmax>** is set to the wind turbine's maximum output power:

  This allows the Windy Boy's maximum AC power to be optimally adjusted to the wind turbine used. This prevents the generator from being overloaded by excessive power extraction.

*Ask the manufacturer of your wind turbine about its typical generator properties (voltage/power characteristic).*

- **<T-Stop>** is set to the maximum value:

  Here, the Windy Boy remains connected to the grid, even at low DC input voltage levels, and "waits" for the next gust of wind. This delays an early switch-off of the Windy Boy.
- **<T-Start>** is set to the minimum value:

This shortens the period waited before activation (please observe the regulations of the local energy supplier).

*Only change the operating parameters if you know exactly what you are doing!*

## 6.5 Changing the Power Curve with the Sunny Data PC Software and the USB Service Interface

In addition to the communication possibilities described in section 7, you can also set parameters using the optional "USB service interface". This special cable enables direct communication between a PC and an individual Windy Boy. The extensions mentioned in section 7 are not necessary for this purpose.

You will need to install the Sunny Data software on your PC. This software is available for free from the download area at www.SMA.de. The Sunny Data software is a PC program for direct monitoring and configuration of your Windy Boy, and also allows visualization and logging of system parameters.

**Note that the USB service interface can only be used by opening the Windy Boy and that the safety instructions in your Windy Boy's operating and installation manuals must be observed.**

**Once you have finished setting the parameters, the service interface must be removed and the Windy Boy must be closed again. This solution is therefore not suitable for permanent installation.**

### Necessary Equipment:

- Windy Boy WB 2500 / 3000
- PC or laptop with Windows 2000, Windows XP Home or Windows XP Professional with a free USB port.
- PC software Sunny Data, version 1.81 or higher (available as a free download at www.SMA.de).
- PC software Sunny Data Control, version 3.81 or higher (available as a free download at www.SMA.de).
- USB service interface (type code: USBPBS).

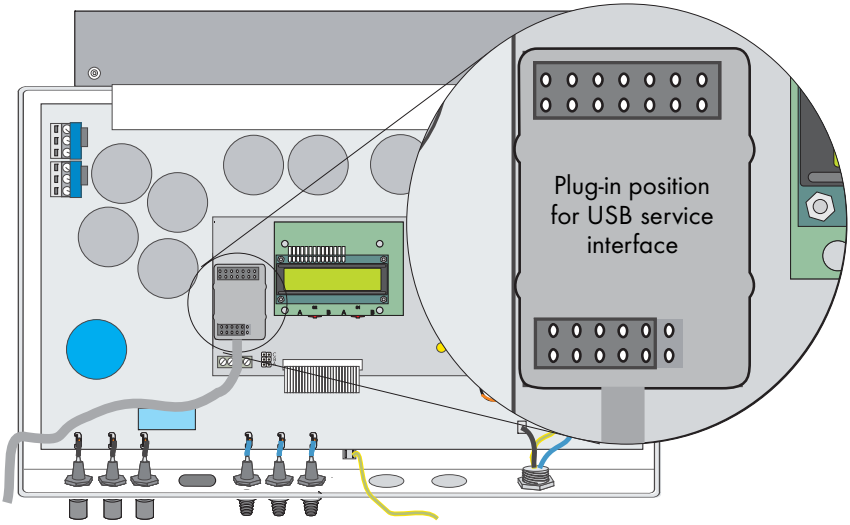
*In order to configure the Windy Boy, a DC input voltage - within the input voltage range of the Windy Boy - must be present. The Windy Boy must also be connected to the grid voltage.*

*Only change the operating parameters if you know exactly what you are doing!*

*The user manual for the USB service interface and the Sunny Data software can be found in the download area at www.SMA.de.*

## 6.5.1 Installation of the USB Service Interface

- Disconnect the Windy Boy from the grid voltage. This is achieved either by pulling the fuse in the domestic power supply, or by pulling out the AC connector of the Windy Boy's grid connection.
- Brake your wind turbine system.
- Switch off the DC circuit breaker.
- Wait for **30 minutes** before continuing, so that the internal voltages can discharge.
- Unscrew the four screws in the housing cover and remove the cover by pulling it forward smoothly. At the same time disconnect the PE connection from the cover. Loosen the locking on the PE connection on the cover when you remove it.
- Connect the USB service interface to the Piggy-Back plug-in position, as shown in the diagram below. The USB service interface must be plugged in, in such a manner that it is aligned to the left. All pins except for the two on the lower right-hand side are connected.




- Connect the USB service interface's USB plug to the USB port on your PC.
- Connect the DC plug connector. Ensure that you connect every plug to the correct socket.
- Release the brake on your wind turbine system.
- Reconnect the Windy Boy to the grid.

- Check whether the Windy Boy's LEDs indicate correct operation.

*In order to configure the Windy Boy, a DC input voltage - within the MPP range of the Windy Boy - must be present. The Windy Boy must also be connected to the grid voltage.*

# 7 Maintenance and Care

To enable the Windy Boy to be used also outdoors in places that are difficult to access, it has been constructed for low maintenance.

However, in the interests of maximum yields, the operator should check, weekly if possible, and under various wind conditions, whether the Windy Boy's display indicates plausible normal operation (see section 4.3.4 "Description of the Operating Modes" (Page 17)). Naturally, this information can also be obtained by using one of the communication options.

It is only necessary to clean the Windy Boy if the heat dissipation is limited by dirt on the cooling fins or in the space between the Windy Boy and the wall. The dirt should be carefully removed with an appropriate soft brush or paint brush.

If the display screen or the status LEDs are so dirty that it is difficult to see them, clean them with a damp cloth. Solvents, abrasives or corrosive materials must not be used for cleaning!

# 8 Extensions

As with all inverters in the Sunny Boy family, the Windy Boy can also be extended with a range of communication interfaces. This provides the operator with the possibility of requesting detailed operating data and error messages, for subsequent analysis on a PC using (e.g.) the free software available from SMA.

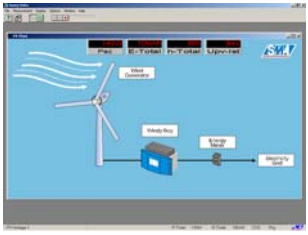
The data can currently be transferred in five different ways:

- using Powerline
- using a separate RS485 cable
- using a separate RS232 cable
- using a radio link (Sunny Beam)
- using the USB service interface (USBPBS), see section 6.5 "Changing the Power Curve with the Sunny Data PC Software and the USB Service Interface" (Page 37).

With the Windy Boy, the wind turbine system can be monitored in a number of different ways. SMA offers a range of products for this purpose, allowing you to install a tailor-made monitoring system for your system. If you require more details regarding the Windy Boy products, order the Sunny Family catalog, or visit www.SMA.de. In the following sections, the communication products currently available are described schematically.

## 8.1 Sunny Data

Sunny Data is a PC program for direct monitoring of your system. The connection of Windy Boys to a PC is described in the following sections.

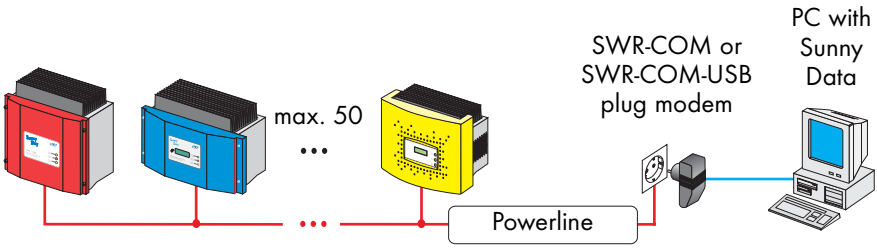


## 8.1.1 Sunny Data Via Powerline

"Wireless" communication via the mains power line.

(up to 50 Windy Boys)

Requirements: The Windy Boys must be equipped with a Powerline Piggy-Back and the PC must be equipped with an SWR-COM / USB-COM plug modem. The connection to a PC via the SWR-COM or SWR-COM-USB is described in the documentation for the SWR-COM / SWR-COM-USB.

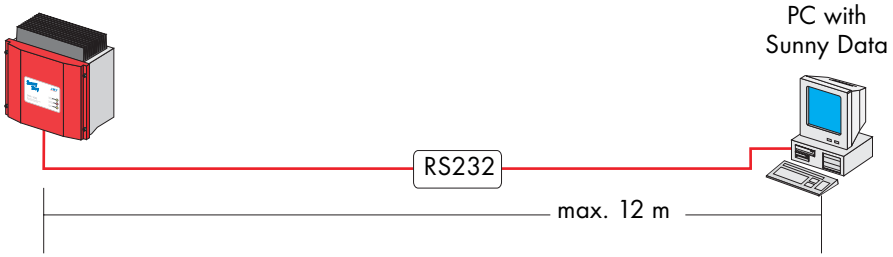



## 8.1.2 Sunny Data Via RS232

Communication via cable.

(one Windy Boy)

Requirements: The Windy Boy must be equipped with an RS232 Piggy-Back, the connection to the PC usually occurs directly via the PC's COM1 or COM2 port. The installation of the RS232 cable is described in the Windy Boy's installation manual.

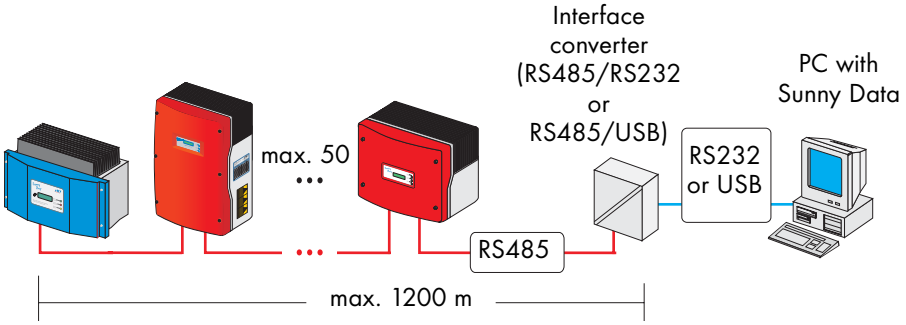


## 8.1.3 Sunny Data Via RS485

Communication via cable.

(up to 50 Windy Boys)

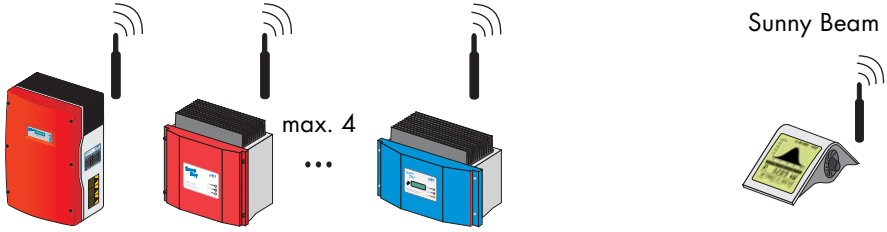
Requirements: All Windy Boys must be equipped with an RS485 Piggy-Back, the connection to the PC usually occurs via an RS485/RS232 interface converter connected to the COM1 or COM2 port or via an RS485/USB interface converter connected to the USB port. The installation of the RS485 Piggy-Back is described in the Windy Boy's installation manual.




## 8.2 Sunny Beam

Simple system monitoring via radio for up to 4 Windy Boys.

Requirements: The Windy Boys must be equipped with a Radio Piggy-Back and a Sunny Beam must be present at an appropriate distance. The installation of Radio Piggy-Backs is described in the Sunny Beam user manual.

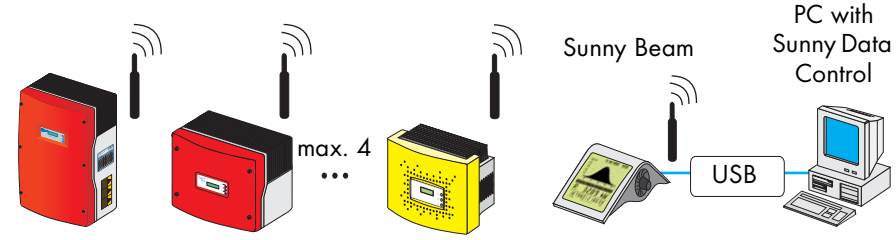


## 8.2.1 Sunny Data Control Via Sunny Beam

Communication with a PC via Sunny Beam

(up to 4 Windy Boys)

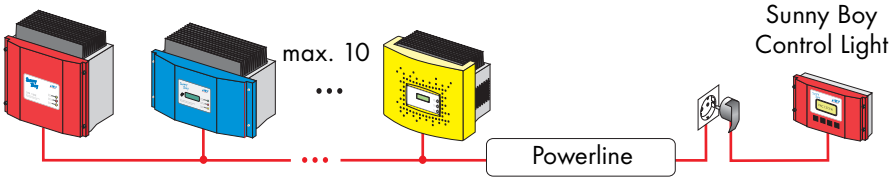
Requirements: All 4 Windy Boys must be equipped with a Radio Piggy-Back and accessible from the Sunny Beam for system monitoring. The Sunny Beam is connected to the PC via a USB cable. The installation of the Radio Piggy-Backs and the connection to the PC is described in the Sunny Beam user manual.




## 8.3 Sunny Boy Control Light

The simple data logger for systems with up to 10 Windy Boys. The connection between the Sunny Boy Control Light and the Windy Boys occurs via Powerline.

Requirements: The Windy Boys must be equipped with a Powerline Piggy-Back. Installation is described in detail in the Sunny Boy Control Light documentation.

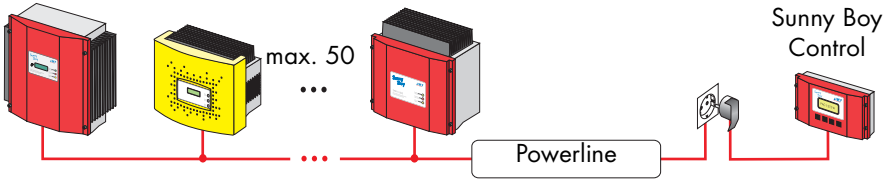


## 8.4 Sunny Boy Control

The data logger for systems with up to 50 Windy Boys. The connection between the Sunny Boy Control and the Windy Boys can be realized as follows:

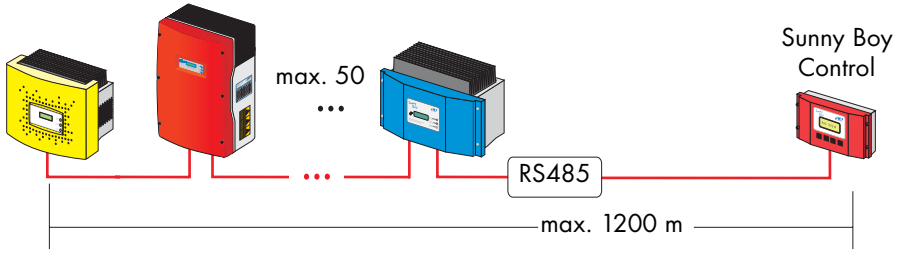
Powerline - "wireless" communication via the mains power line.

Requirements: All the Windy Boys must be equipped with a Powerline Piggy-Back.




RS485 communication via cable.

Requirements: All Windy Boys must be equipped with an RS485 Piggy-Back, and the Sunny Boy Control must be equipped with an RS485 Piggy-Back at the "COM1 - Sunny Boy" interface.



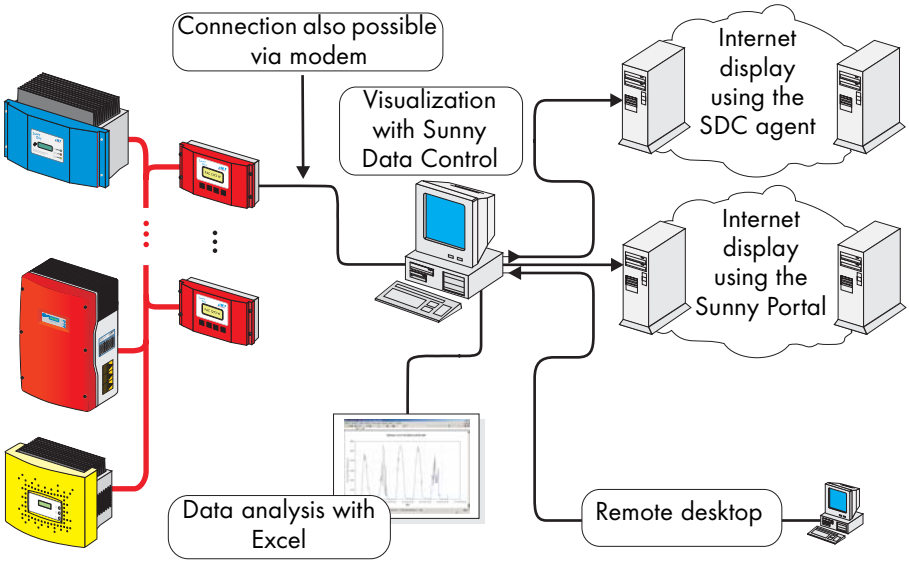

## 8.5 Sunny Boy Control Plus

The data logger for systems with up to 50 Windy Boys, an additional interface for connection to a PC or to a large display and additional connection possibilities for digital and analog inputs and outputs. Requirements: See section 8.4 "Sunny Boy Control" (Page 47).

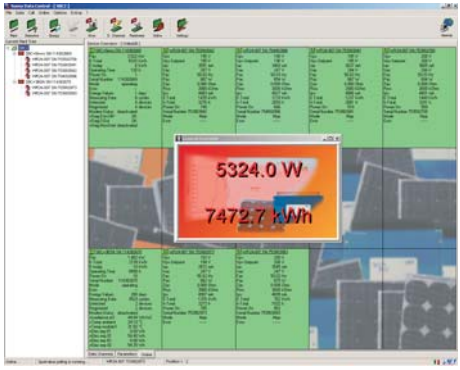
## 8.6 Sunny Data Control

The PC program for system monitoring and visualization on a PC for systems with a Sunny Boy Control.

Requirements: A system with a Sunny Boy Control, Sunny Boy Control Plus or Sunny Boy Control Light with a connection to a PC.

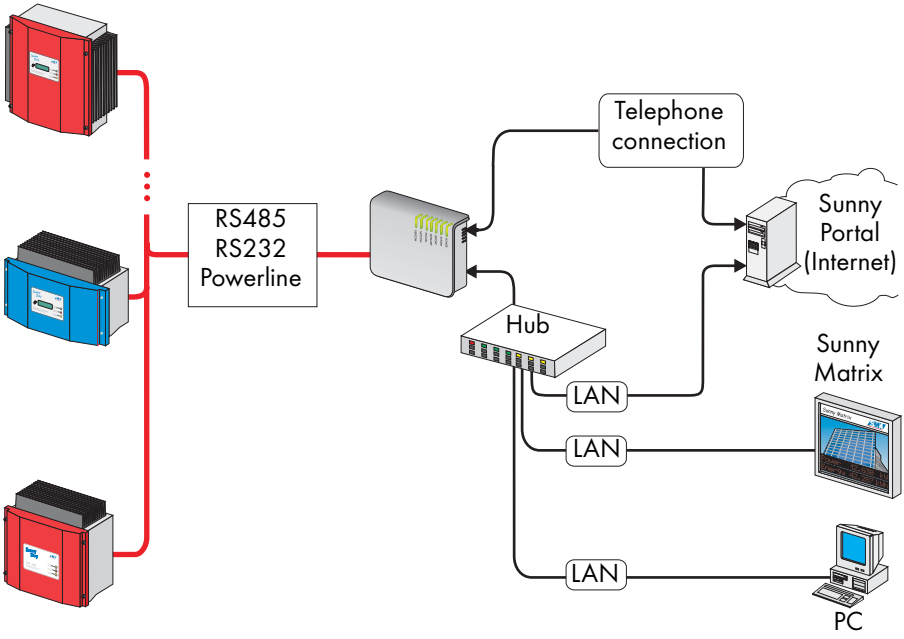



The connection between the PC and the Sunny Boy Control can be made via modem if required. Large systems with more than 50 Windy Boys can be monitored by coupling several Sunny Boy Controls together.



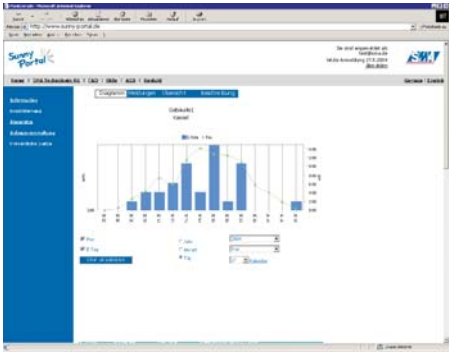
## 8.7 Sunny WebBox

The Sunny WebBox is a versatile inexpensive platform for system visualization directly at a PC or via the Internet using the Sunny Portal.




## 8.8 Sunny Portal

The Sunny Portal is a high performance interface from SMA for the monitoring and presentation of your system in the Internet. Details can be obtained from the Sunny Family catalog or directly at www.SUNNY-PORTAL.com.



# 9 Technical Data

## 9.1 WB 2500

| Description | Short descr. | Value |
|---|---|---|
| **Generator connection data** | | |
| Max. input open circuit voltage | $V_{DC\ 0}$ | 600 V |
| Input voltage range | $V_{DC}$ | 224 V ... 600 V |
| Nominal DC operating voltage | $V_{DC\ nom}$ | 300 |
| Max. input current | $I_{DC\ max}$ | 12 A |
| Max. input power | $P_{DC}$ | 2700 W |
| Recommended generator power at 5000 full-load-hours / year | $P_{turb\ max}$ | 1760 W |
| Recommended generator power at 2500 full-load-hours / year | $P_{turb\ max}$ | 1980 W |
| Connection of the DC input side | | DC plug connectors |
| Overvoltage protection | | thermally monitored varistors |
| Voltage ripple | $V_{pp}$ | < 10 % of the input voltage |
| Insulation protection | | ground fault monitoring (Riso > 1 MOhm) |
| Operating consumption | | < 7 W (standby) |
| Reverse polarity protection | | via short-circuit diode |

| Description | Short descr. | Value |
|---|---|---|
| **Grid connection data** | | |
| Nominal output power | $P_{ACnom}$ | 2200 W |
| Output peak power | $P_{ACMax}$ | 2500 W |
| Nominal output current | $I_{ACnom}$ | 9,6 A |
| Harmonic distortion of output current (at $K_{UNetz}$ < 2 %, $P_{AC}$ > 0,5 $P_{ACnom}$) | THD | < 4 % |
| Short-circuit proofing | | grid-side via current regulation |
| Operating range, grid voltage | $V_{AC}$ | 180 ... 265 V AC<br>Germany: 198 ... 253 / 260[a)] V AC |
| Operating range, grid frequency | $f_{AC}$ | 45,5 ... 54,5 Hz<br>Germany: 47,55 ... 50,2 Hz |
| All-pole isolator on grid side | | automatic disconnection device ("SMA grid guard 2"), double implementation |
| Power factor (based on the current's fundamental frequency) | cos Phi | 1 |
| Overvoltage category | | III |
| Test voltage (DC) | | 1,4 kV<br>(1 s routine testing / 5 s type testing) |
| Test surge voltage | | 4 kV (serial interface: 6 kV) |

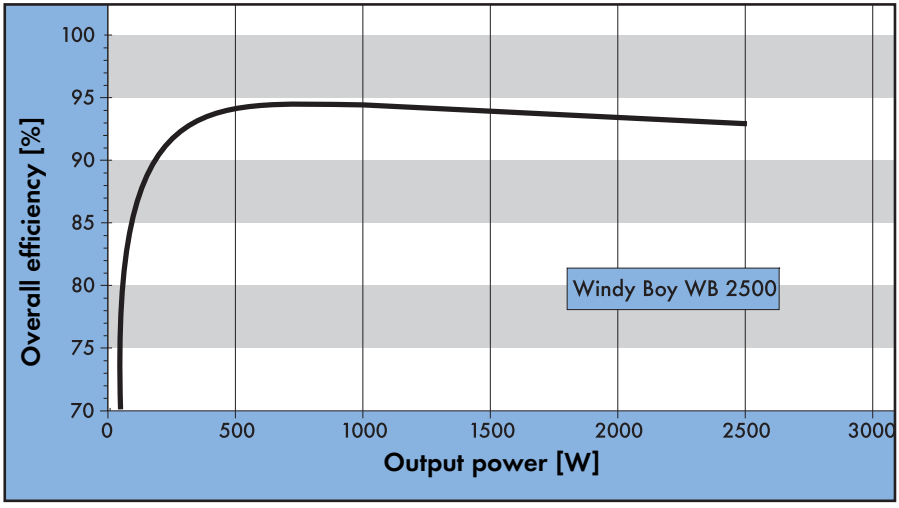
| Description | Short descr. | Value |
|---|---|---|
| **Efficiency** | | |
| Max. efficiency | ηmax | 94,1 % |
| European standard efficiency | ηeuro | 93,2 % |

a) The Sunny Boy SB 1100LV can temporarily feed power into the grid with a maximum output voltage of 260 V. According to DIN VDE 0126-1-1, however, the 10-minute average must not exceed a voltage of 253 V. That means, if the grid voltage is constantly 254 V (e.g.), the inverter disconnects itself from the grid. In this case, contact the local grid operator for assistance.

DIN VDE 0126-1-1 only applies in Germany. See chapter 10.1.5 "Country-Specific Parameter Settings" (Page 67) for all other preset country values of your inverter.

## Efficiency of the WB 2500

The efficiency of the Windy Boy depends mainly on the DC input voltage. The lower the input voltage, the higher the efficiency.



## 9.2 WB 3000

| Description | Short descr. | Value |
|---|---|---|
| **Generator connection data** | | |
| Max. input open circuit voltage | $V_{DC\ 0}$ | 600 V |
| Input voltage range | $V_{DC}$ | 268 V ... 600 V |
| Nominal DC operating voltage | $V_{DC\ nom}$ | 350 |
| Max. input current | $I_{DC\ max}$ | 12 A |
| Max. input power | $P_{DC}$ | 3200 W |
| Recommended generator power at 5000 full-load-hours / year | $P_{turb\ max}$ | 2080 W |
| Recommended generator power at 2500 full-load-hours / year | $P_{turb\ max}$ | 2340 W |
| Connection of the DC input side | | DC plug connectors |
| Overvoltage protection | | thermally monitored varistors |
| Voltage ripple | $V_{pp}$ | < 4 % of the input voltage |
| Insulation protection | | ground fault monitoring (Riso > 1 MOhm) |
| Operating consumption | | < 7 W (standby) |
| Reverse polarity protection | | via short-circuit diode |

| Description | Short descr. | Value |
|---|---|---|
| **Grid connection data** | | |
| Nominal output power | $P_{ACnom}$ | 2600 W |
| Output peak power | $P_{ACMax}$ | 3000 W |
| Nominal output current | $I_{ACnom}$ | 11,3 A |
| Harmonic distortion of output current (at $K_{UNetz}$ < 2 %, $P_{AC}$ > 0,5 $P_{ACnom}$) | THD | < 4 % |
| Short-circuit proofing | | grid-side via current regulation |
| Operating range, grid voltage | $V_{AC}$ | 180 ... 265 V AC<br>Germany: 198 ... 253 / 260[a)] V AC |
| Operating range, grid frequency | $f_{AC}$ | 45,5 ... 54,5 Hz<br>Germany: 47,55 ... 50,2 Hz |
| All-pole isolator on grid side | | automatic disconnection device ("SMA grid guard 2"), double implementation |
| Power factor (based on the current's fundamental frequency) | cos Phi | 1 |
| Overvoltage category | | III |
| Test voltage (DC) | | 1,4 kV<br>(1 s routine testing / 5 s type testing) |
| Test surge voltage | | 4 kV (serial interface: 6 kV) |

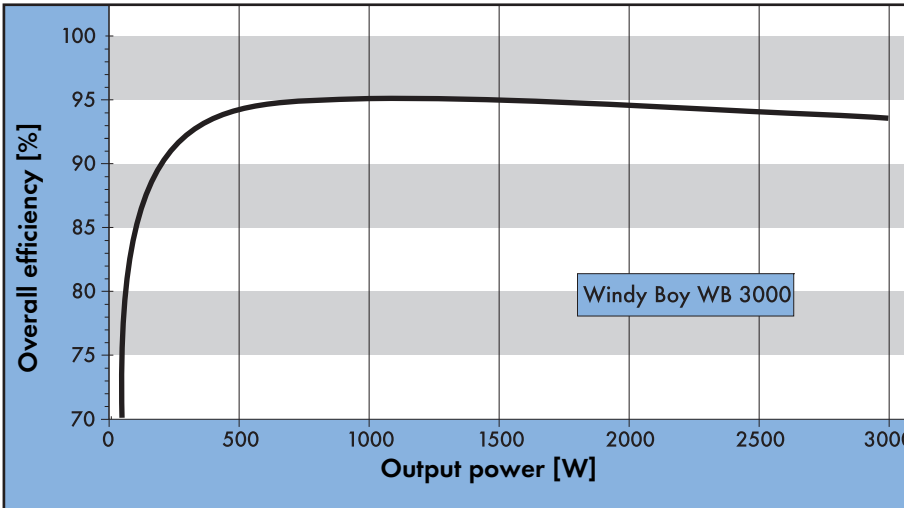
| Description | Short descr. | Value |
|---|---|---|
| **Efficiency** | | |
| Max. efficiency | ηmax | 95,0 % |
| European standard efficiency | ηeuro | 93,6 % |

a) The Sunny Boy SB 1100LV can temporarily feed power into the grid with a maximum output voltage of 260 V. According to DIN VDE 0126-1-1, however, the 10-minute average must not exceed a voltage of 253 V. That means, if the grid voltage is constantly 254 V (e.g.), the inverter disconnects itself from the grid. In this case, contact the local grid operator for assistance.

DIN VDE 0126-1-1 only applies in Germany. See chapter 10.1.5 "Country-Specific Parameter Settings" (Page 67) for all other preset country values of your inverter.

## Efficiency of the WB 3000

The efficiendy of the Windy Boy depends mainly on the DC input voltage. The lower the input voltage, the higher the efficiency.



## 9.3 General Data

| Genral Data | |
|---|---|
| Protection type to DIN EN 60529 | IP65 |
| Dimensions (w x h x d) | ca. 434 mm x 295 mm x 214 mm |
| Weight | approx. 32 kg |

| External Interfaces | |
|---|---|
| Data transmission via powerline | optional |
| Datenübertragung over separate data cable | optional, RS232 / RS485, electrically separated |
| Wireless data transmission | optional |

# 10 General Information

## 10.1 Measurement Channels and Messages

If your Windy Boy is equipped with a communication component, then numerous measurement channels and messages can be incorporated into diagnostics. These can be useful for improved performance and for error prevention. The following abbreviations apply:

**BFR:** Operation control unit

**SRR:** Current control unit

| Name | Explanation |
|---|---|
| Error | Identification of the present fault / error |
| Errorr-Cnt | The number of errors which have occurred since the last reset |
| E-Total | Total amount of feed-in energy |
| Event-Cnt | The number of events which have occurred since the last reset |
| Fac | Grid frequency |
| h-On | Total number of operational hours |
| h-Total | Total number of operational hours with grid feeding |
| Iac | Grid current |
| Ipv | DC current |
| Mode | Display of the current operating mode |
| Pac | Grid power provided |
| Power On | Total number of grid switch-ons |
| Riso | Insulation resistance of the system to the grid connection |
| Serial Number | Serial number of the Windy Boy |
| Vac | Grid voltage |
| Vpv | DC input voltage |
| Vpv-Setpoint | Nominal DC voltage |
| Zac | Grid impedance |

*The measurement channels provide information in German (e.g. "Fehler"), or in English (e.g. "Error"), depending on which software you are using (Sunny Data or Sunny Data Control).*

## 10.1.1 Status Messages

The Windy Boy produces a range of status messages, depending on the mode in which it is currently operating. The status messages can vary, depending on the type of communication system you are using.

| Name | Explanation |
|---|---|
| Derating | Overtemperature in inverter. The Windy Boy reduces its performance to prevent the device from overheating. Check whether the Windy Boy can be installed in a more favorable position with better ventilation, so that sufficient heat dissipation can be guaranteed. |
| Fehler / Error | An error has been detected (see section 10.2 "Error Messages" (Page 70)). |
| I-Konst | Operating mode for test purposes |
| Off Grid | The Windy Boy is in Off Grid mode. This mode is specially conceived for operation in a stand-alone grid with a Sunny Island as grid controller. More information about this topic can be obtained from the Sunny Island operating manual under the category "Droop Mode". |
| MPP | The Windy Boy is operating in MPP mode. The Windy Boy takes the highest possible power output from the PV generator. MPP is the standard display when operating with normal solar irradiation (PV operation only!). |
| Mpp Peak | The Windy Boy is operating in MPP mode above its nominal power level (PV operation only!). |
| Netzueb. / grid mon. | Testing the grid status (grid impedance), relay test, etc. This message only appears during the startup phase, before the Windy Boy is connected to the grid. This message mainly appears when there is little or no wind. |
| Offset | Offset compensation of the measurement electronics. |
| Riso | Measurement of the wind turbine system's insulation resistance. |
| Stoer. / disturb. | Fault (see table "Error Messages"). This error occurs for reasons of safety and prevents the Windy Boy from connecting to the grid. This status can also be set manually. |
| Stop | Interruption of operation after a fault. This status can also be set manually. |
| Turbine Mode | Factory setting for Windy Boy inverters. The input voltage is processed according to the programmable power curve. See section 6 "Turbine Operation" (Page 31). |

| Name | Explanation |
|---|---|
| U-Konst / V-Const | Constant voltage operation (the input voltage is predefined; the Windy Boy operates in neither MPP mode nor Turbine mode). In some cases, this can be set as the operating mode. |
| Warten / waiting | The switch-on conditions are not (yet) satisfied. |

## 10.1.2 Windy Boy Operating Parameters

**Unauthorized changes to the operating parameters may result in:**

- **injury or accidents due to changed internal safety routines in the Windy Boy,**
- **voiding the Windy Boy's operating approval certificate,**
- **voiding the Windy Boy's warranty.**

**Never change the parameters of your Windy Boy without explicit authorization and instructions.**

## 10.1.3 Explanation of the Operating Parameters

*Parameters shown in bold are necessary for the programmable wind curve and for adjusting a wind turbine system to the Windy Boy (see also section 6 "Turbine Operation" (Page 31)).*

| Name | Explanation |
|---|---|
| ACVtgRPro | Voltage rise protection (only relevant for inverters, which are preset to GER/VDE 0126-1-1).<br>Windy Boys can feed into the public grid in Germany with up to 260 V AC. However, DIN VDE 0126-1-1 stipulates that the average AC voltage over 10 minutes must not exceed 253 V. If the average over 10 minutes exceeds the threshold value of 253 V, the inverter disconnects itself from the grid. Once the average over 10 minutes returns to a value of less than 253 V, the inverter resumes grid feeding. If surge voltage protection is not required in the relevant grid area (outside Germany), it can be deactivated by presetting the LDVtgC parameter. In this event, only the fast cut-off via the Uac-Max parameter intervenes. |
| AntiIsland-Ampl | Amplification of the AntiIsland process (alternative anti-islanding process, which is deactivated for Germany). |

| Name | Explanation |
|---|---|
| AntiIsland-Freq | Repetition rate of the AntiIsland process (alternative anti-islanding process, which is deactivated for Germany). |
| **Betriebsart / Operating mode** | Operating mode of the Windy Boy:<br>MPP: Maximum power point<br>UKonst: Constant voltage mode (target voltage is defined in "Usoll-Konst")<br>IKonst: Operating mode for test purposes<br>Stop: Disconnection from grid, no operation<br>Turbine Mode: Operating mode for wind turbine systems.<br>Off Grid: Operating mode for Windy Boys in a stand-alone grid. |
| Default | Used for setting country-specific information.<br>GER/ENS: Country-specific parameter settings for Germany in accordance with DIN VDE 0126 (04.99)<br>GER/VDE0126-1-1: Country-specific parameter settings for Germany in accordance with DIN VDE 0126-1-1<br>SP/RD1663: Country-specific parameter settings for Spain<br>GB/G83: Country-specific parameter settings for Great Britain<br>Other: Here, parameter settings can be defined for countries for which no predefined setting exists.<br>Trimmed: If country-specific parameters have been changed, "trimmed" is shown in the display. |
| dFac-Max | Maximum "grid frequency change" before the grid monitoring system disconnects the device from the grid. |
| dZac-Max | Maximum "grid impedance change" before the grid monitoring system disconnects the device from the grid. |
| E_Total | Total energy yield for the inverter. It may be necessary to change this parameter if you replace the Windy Boy and want to use the data from the old device. |
| Fac-delta-<br>Fac-delta+ | Maximum deviation in frequency, above (Fac-delta+) and below (Fac-delta-) the grid frequency, before the grid monitoring system disconnects the device from the grid. |
| Fac-Limit delta | For setting the frequency-dependent ouput derating in the operating mode "Off Grid". Further information on this topic can be found in the Sunny Island manuals. |
| Fac-Pderating | Frequency-dependent output limitation. |

| Name | Explanation |
|---|---|
| Fac-Start delta | For setting the frequency-dependent ouput derating in the operating mode "Off Grid". Further information on this topic can be found in the Sunny Island manuals. |
| Fac-Tavg | Averaging time of grid frequency measurement. |
| h_Total | Total number of operational hours of the inverter. It may be necessary to change this parameter if you replace the Windy Boy and want to use the data from the old device. |
| I-Ni-Test | Impulse setting for impedance monitoring. This parameter only takes effect when the Windy Boy is deactivated (disconnected on the AC side) or in "Stop" mode. |
| Inst.-Code | Parameters for stand-alone grid recognition can only be changed after entering the SMA grid guard password. |
| **KI-Wind-Reg** | Control speed: Do not change default setting. |
| **KP-Wind-Reg** | Control speed: Higher value increases controller speed, lower value reduces controller speed. A lower value reduces oscillations of the input side of the Windy Boy. |
| LDVtgC | Compensation for the voltage drop in the cabling.<br>With this parameter, the voltage drop between the inverter and the grid connection point is taken into account. The 10-minute average voltage at the inverter connection must not exceed the sum of ACVtgRPro plus LDVtgC. The parameter LDVtgC is preset to 0 V for inverters, which are preset to GER/VDE 0126-1-1. The parameter LDVtgC is preset to 50 V for grid areas in which the additional surge voltage protection is not required (see parameter ACVtgRPro). Thus, the surge voltage protection is deactivated for these grid areas (253 V + 50 V = 303 V) and only the fast cut-off via the Uac-Max parameter intervenes. |
| Plimit | Upper limit for AC output power. |
| **Pmax** | Reduces the Windy Boy's maximum output power to adapt to wind turbines with lower output power. |
| **P-Wind-Mid** | Defines the power threshold, after which the curve climbs more steeply. |
| **P-Wind-Ramp** | Controls a delayed startup of the characteristic curve, only after the Windy Boy has been switched on. This prevents the generator from being suddenly presented with a heavy load. |

| Name | Explanation |
|---|---|
| Ripple-Ctl-Frq<br>Ripple-Ctl-Lev<br>Ripple-Ctl-Rcvr | The Ripple-Ctl-Frq, Ripple-Ctl-Lev, Ripple-Ctl-Rcvr parameters are intended to handle ripple control signals with Windy Boys. These parameters may only be changed after prior agreement with **SMA** Technologie AG. |
| SMA-SN | Serial number of the Windy Boy |
| Software-BFR | Firmware version of the operation control unit (BFR). |
| Software-SRR | Firmware version of the current control unit (SRR). |
| Speicherfunkt. /<br>Memory funct. | Default Parameter: returns all parameters to the factory settings.<br>Reset Betriebsdaten: returns all user level parameters to the factory settings.<br>Reset Fehler: resets a permanent error. |
| **T-Start** | Grid synchronization start timer. |
| **T-Stop** | Stop timer for aborting the supply of power and switching off. |
| Uac-Min<br>Uac-Max | Lower (Uac-Min) and upper (Uac-Max) limits of the allowable AC voltage (stand-alone grid recognition), before the grid monitoring system disconnects the device from the grid. |
| Uac-Tavg | Averaging time for measuring grid frequency. |
| **UdcWindMax** | Defines the voltage at the moment when the Windy Boy begins feeding maximum power into the grid. |
| **UdcWindMid** | Defines the voltage threshold, after which the curve climbs more steeply. |
| **UdcWindStart** | Defines the voltage at the moment when the Windy Boy begins to feed power into the mains grid, and begins to extract power from the turbine. |
| **Upv-Start** | Defines the voltage at the moment when the Windy Boy is ready to perform grid synchronization. |
| Usoll-Konst | Target DC voltage for constant operational voltage. These parameters are only important when the "Betriebsart" parameter is set to U-konst. |

## 10.1.4 Parameter Settings for Germany

Grayed-out parameters are only displayed in installer mode. The table below contains the parameters that are applicable in Germany.

| Name | Unit | Value Range | | Factory Setting | |
|---|---|---|---|---|---|
| | | **WB 2500** | **WB 3000** | **WB 2500** | **WB 3000** |
| ACVtgRPro | V | 230 ... 300 V | | 253 | |
| AntiIsland-Ampl * | grd | 0 ... 10 | | 0 | |
| AntiIsland-Freq * | mHz | 0,1 ... 2000 | | 500 | |
| **Betriebsart** | | MPP-Operation, V-Const, Stop, Turbine | | Turbine | |
| Default * | | GER/ENS, GER/VDE 0126-1-1, SP/RD1663, AUS/AS4777, USA, IT, GB/G83, Off_Grid, Other, trimmed | | GER/VDE 0126-1-1 | |
| dFac-Max * | Hz/s | 0,1 ... 4,0 | | 4 | |
| dZac-Max * | mohm | 350 ... 20000 | | 700 | |
| E_Total | kWh | 0 ... 200000 | | 0 | |
| Fac-delta- * | Hz | 0,1 ... 4,5 | | 2,45 | |
| Fac-delta+ * | Hz | 0,1 ... 4,5 | | 0,19 | |
| h_Total | h | 0 ... 200000 | | 0 | |
| I-NiTest * | mA | 0 ... 15000 | | 8000 | 9000 |
| Inst.-Code | | | | | |
| **KI-Wind-Reg** | | 0 ... 0,25 | | 0,005 | |
| **KP-Wind-Reg** | | 0 ... 0,25 | | 0,020 | |
| LDVtgC | | 0 ... 50 | | 0 | |
| **Pmax** | W | 0 ... 2550 | 0 ... 3050 | 2500 | 3000 |
| **P-Wind-Mid** | W | 0 ... 2550 | 0 ... 3050 | 300 | 400 |
| **P-Wind-Ramp** | W/s | 10 ... 2000 | | 500 | |
| Speicherfunktion | | Default Param., Reset Betrdaten, Reset Fehler | | none | |
| **T-Start *** | s | 5 ... 300 | | 10 | |

| Name | Unit | Value Range | | Factory Setting | |
|---|---|---|---|---|---|
| | | WB 2500 | WB 3000 | WB 2500 | WB 3000 |
| **T-Stop** | s | 1 ... 3600 | | 2 | |
| Uac-Min * | V | 160 ... 230 | | 198 | |
| Uac-Max * | V | 230 ... 300 | | 260 | |
| **UdcWindMax** | V | 150 ... 600 | | 550 | |
| **UdcWindMid** | V | 150 ... 600 | | 400 | 420 |
| **UdcWindStart** | V | 150 ... 600 | | 250 | 270 |
| **Upv-Start** | V | 250 ... 600 | 290 ... 600 | 300 | 330 |
| Usoll-Konst | V | 250 ... 600 | | 600 | |

*Parameters designated with * are safety-related grid monitoring parameters. To change the SMA grid guard parameters, you must enter your personal SMA grid guard password (Inst.-Code). Call the Sunny Boy hotline to obtain your personal SMA grid guard password.*

## 10.1.5 Country-Specific Parameter Settings

The parameters listed below represent country-specific settings and are only displayed in installer mode. All other parameters are international and can be viewed in the table in section 10.1.4.

*The default settings for GER/VDE0126-1-1, USA, IT and AUS are not described here, because the Windy Boy WB 2500 / 3000 has no certification for these countries.*

### Windy Boy WB 2500

| Name | Unit | Country Settings | | |
|---|---|---|---|---|
| | | **Germany** | **Great Britain** | **Spain** |
| Default | | GER/VDE0126-1-1 | GB/G83 | SP/RD1663 |
| dFac-Max | Hz/s | 4 | 0,25 | 2 |
| dZac-Max | mOhm | 700 | 350 | 350 |
| Fac-delta- | Hz | 2,45 | 0,5 | 0,98 |
| Fac-delta+ | Hz | 0,19 | 0,5 | 0,98 |
| I-NiTest | mA | 8000 | 0 | 0 |
| LDVtgC | V | 0 | 50 | 50 |
| T-Start | s | 10 | 180 | 10 |
| Uac-Min | V | 198 | 209 | 199 |
| Uac-Max | V | 260 | 261 | 250 |

## Windy Boy WB 3000

| Name | Unit | Country Settings | | |
|---|---|---|---|---|
| | | **Germany** | **Great Britain** | **Spain** |
| Default | | GER/ VDE0126-1-1 | GB/G83 | SP/RD1663 |
| dFac-Max | Hz/s | 4 | 0,25 | 2 |
| dZac-Max | mOhm | 700 | 350 | 350 |
| Fac-delta- | Hz | 2,45 | 0,5 | 0,98 |
| Fac-delta+ | Hz | 0,19 | 0,5 | 0,98 |
| I-NiTest | mA | 9000 | 0 | 0 |
| LDVtgC | V | 0 | 50 | 50 |
| T-Start | s | 10 | 180 | 10 |
| Uac-Min | V | 198 | 209 | 199 |
| Uac-Max | V | 260 | 261 | 250 |

## 10.1.6 Non-Modifiable Parameters

The following parameters are displayed in the parameter list but cannot be changed:

| Name | Unit | Factory Setting | |
|---|---|---|---|
| | | **WB 2500** | **WB 3000** |
| Fac-Pderating | | | |
| Fac-Tavg | ms | 160 | |
| Plimit | W | 2500 | 3000 |
| SMA-SN | | | |
| Software-BFR | | | |
| Software-SRR | | | |
| Uac-Tavg | ms | 80 | |

## 10.2 Error Messages

If an error occurs, the Windy Boy generates a message, which is dependent on the operating mode and the type of error detected.

| Error Code | Description |
|---|---|
| !PV-Overvoltage!<br>!DISCONNECT DC ! | Overvoltage at DC input.<br>**Immediately disconnect the inverter from the PV generators! Otherwise, the inverter may be damaged.**<br>Check the configuration of your system and measure the DC voltage before reconnecting the inverter to the DC voltage. |
| ACVtgRPro | The average grid voltage over 10 minutes is no longer within the permissible range.<br>This can be due to either of the following reasons:<br>• The grid voltage at the connection point is too high.<br>• The grid impedance at the connection point is too high.<br>The inverter disconnects to allow compliance with the voltage quality of the grid. Check the grid voltage at the Windy Boy's connection point. If, due to the local grid conditions, the grid voltage increases to 253 V or more, ask the grid operator whether the voltage at the feed-in point can be adjusted, or whether they agree to an alteration of the threshold value ACVtgRPro (operating parameter: ACVtgRPro) for voltage quality monitoring. If the grid voltage is continuously within the acceptable range, yet the "ACVtgRPro" error is still displayed, contact the SMA hotline. |
| Bfr-Srr | Internal measurement comparison error or hardware defect. Contact SMA if this error occurs frequently. |
| derating | Once the Windy Boy enters the "Derating" mode, it displays the "derating" warning until the next time the device is switched off. If this warning appears frequently, check the heat dissipation of your device. |
| dFac-Bfr /<br>dFac-Srr | The changes in grid frequency are outside the permissible range ("Bfr" or "Srr" is an internal message which has no meaning for the user).<br>The Windy Boy disconnects from the grid in order to avoid potential damage or islanding. If possible, check the grid frequency and observe how often major deviations occur. If repeated deviations occur and this is causing "dFac-Bfr" or "dFac-Srr" errors, ask the grid operator if they agree to a modification of the operating parameters. Discuss the proposed parameters with the SMA hotline. |

| Error Code | Description |
|---|---|
| dZac-Bfr / dZac-Srr | The changes in grid impedance are outside the permissible range ("Bfr" or "Srr" is an internal message which has no meaning for the user).<br>The Windy Boy disconnects from the grid in order to avoid potential damage or islanding. If possible, check the grid impedance and observe how often major deviations occur. If repeated deviations occur and this is causing "dZac-Bfr" or "dZac-Srr" errors, ask the grid operator if they agree to a modification of the operating parameters. Discuss the proposed parameters with the SMA hotline. |
| EEPROM | A transfer error occurred during reading or writing of EEPROM data. This data is not relevant for safe operation - this error has no effect on performance. |
| EEPROM dBh | EEPROM data is defective. The device switches itself off because the loss of data has disabled important functions of the Windy Boy. Contact SMA. |
| EeRestore | One of the duplicate data sets in EEPROM is defective and has been reconstructed without loss of data. |
| Fac-Bfr / Fac-Srr | The grid frequency is no longer within the permissible range ("Bfr" or "Srr" is an internal message that has no meaning for the user). The Windy Boy disconnects from the grid in order to avoid potential damage or islanding. Check the grid frequency and the grid connection at the Windy Boy. If the grid frequency lies outside the permissible range because of local grid conditions, ask the grid operator if they agree to a modification of the operating parameters.<br>If the grid frequency lies within the tolerance range, yet "Fac-Bfr" or "Fac-Srr" errors are still being displayed, contact the SMA hotline. |
| Imax | Overcurrent on the AC side. This error code is displayed if the current in the AC grid is larger than specified. Check the system configuration and the grid conditions. |
| K1-Schliess / K1-Trenn | Error during relay test. Contact SMA if this error occurs often or several times in succession. |
| MSD-Fac | Internal measurement comparison error or hardware defect. Contact SMA if this error occurs frequently. |
| NUW-Timeout | Internal measurement comparison error or hardware defect. Contact SMA if this error occurs frequently. |
| MSD-Vac | Internal measurement comparison error or hardware defect. Contact SMA if this error occurs frequently. |

| Error Code | Description |
|---|---|
| MSD-Zac | Internal measurement comparison error or hardware defect. Contact SMA if this error occurs frequently. |
| Offset | Error in the acquisition of measurement data. Contact SMA if this error occurs frequently. |
| Riso | A grounding error has occurred, or one of the thermally monitored varistors on the DC input side is defective as a result of overvoltage. Consult a trained electrician to have the fault corrected. You can find instructions on how to change the varistors in the installation manual. |
| ROM | The Windy Boy firmware is faulty. Contact SMA if this error occurs frequently. |
| Shutdown | Temporary Windy Boy fault |
| Trafo-Temp-F | Unacceptably high temperatures have occurred at the transformer. The Windy Boy stops feeding the grid until the temperature lies within the acceptable range once more. If this error occurs frequently, check the heat dissipation. |
| Trafo-Temp-W | If the transformer reaches an unacceptably high temperature, the Windy Boy stops feeding the grid until the transformer has returned to an acceptable temperature and grid feeding can resume. The Trafo-Temp-W warning is displayed until the next time the device is switched off. Check the Windy Boy's heat dissipation. |
| Vac-Bfr / Vac-Srr | The grid current is no longer within the permissible range ("Bfr" and "Srr" are internal messages which have no meaning for the user). The Vac error can have the following causes:<br>• Grid disconnected (circuit breaker or fuse)<br>• AC cable is broken<br>• AC cable has a high internal resistance<br>For reasons of safety, the Windy Boy disconnects itself from the grid. Check the grid voltage and the grid connection at the Windy Boy. If the grid voltage lies outside the acceptable range because of local grid conditions, ask the grid operator if the voltages can be adjusted at the feed-in point, or if they agree to changes in the values of the monitored operational limits.<br>If the grid voltage lies within the tolerance range, yet "Vac-Bfr" or "Vac-Srr" errors are still being displayed, contact the SMA hotline. |

| Error Code | Description |
|---|---|
| UpvMax | Overvoltage at DC input.<br>**Immediately disconnect the DC input of the Windy Boy. Otherwise the Windy Boy could be severely damaged!**<br>Check the configuration of your system and measure the DC voltage before reconnecting the Windy Boy to the DC voltage. |
| Watchdog | Error message in the program code flow monitoring. |
| Zac-Bfr /<br>Zac-Srr | The grid impedance is no longer within the permissible range ("Bfr" or "Srr" is an internal message which has no meaning for the user). The Windy Boy disconnects from the grid in order to avoid potential damage or islanding. The impedance is calculated from the grid impedance and the impedance of the Windy Boy's grid connection cable (AC cable).<br>Check the grid impedance and the grid connection at the Windy Boy. Use a cable with an adequate cross-section (= low impedance), observe the advice to this effect in the installation manual. If the grid impedance is still too high, ask the grid operator if the grid characteristics at the feed-in point can be altered. |

# 10.3 Declaration of Conformity (CE)

## CE Declaration of Conformity

for utility interactive inverters

**Product:** **Windy Boy**
**Type:** **WB 700, WB 1100, WB 1100LV, WB 1700, WB 2500, WB 2800i, WB 3000**

We declare that the above specified devices are compliant with the regulations of the European Community, in terms of the design and the version fabricated by SMA. This especially applies for the EMC Regulation defined in 89/336/EWG and the low voltage regulation defined in 73/23/EWG.

The devices are compliant with the following standards:

| | |
|---|---|
| EMC: | |
| Emission: | DIN EN 61000-6-3: 2002-08 |
| | DIN EN 61000-6-4: 2002-08 |
| | DIN EN 55022: 2003-09, class B |
| Utility Interference: | DIN EN 61000-3-3: 2002-05 |
| | DIN EN 61000-3-2: 2001-12 |
| Immunity: | DIN EN 61000-6-1: 2002-08 |
| | DIN EN 61000-6-2: 2002-08 |
| Safety: | DIN EN 50178: 1998-04 |
| Semiconductor-Converter: | DIN EN 60146-1-1: 1994-03 |

**The above mentioned devices are therefore marked with a CE sign.**

Note:
This declaration of conformity becomes invalid in case
- the product is modified, complemented or changed,
- and/or components, other than those belonging to the SMA accessories, are installed in the product,
- as well as in case of incorrect connection or inproper usage

without explicit written confirmation by SMA.

Niestetal, 13.06.2006

**SMA** Technologie AG

i.V. Frank Greizer

i.V. Frank Greizer
(Head of Development Department Solar Technology)

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WB-K16A-CE-12:BE2406

# Manufacturer's Declaration for the Transferability of Certificates for "Sunny Boy" Inverters to "Windy Boy" Inverters

Windy Boy

Windy Boy

**WB 700, WB 1100, WB 1100LV, WB 1700, WB 2500, WB 2800i, WB 3000, WB 3300, WB 3800, WB 5000(A), WB 6000(A)**

**Herstellererklärung für die Übertragbarkeit von Zertifikaten für "Sunny Boy" Wechselrichter auf "Windy Boy" Wechselrichter**

Die Wechselrichter der Windy Boy Produktserie sind absolut baugleich mit dem dazugehörigen Sunny Boy Wechselrichter (siehe Tabelle). Jeder Sunny Boy Wechselrichter kann somit als Windy Boy betrieben werden und umgekehrt. Die jeweilige Betriebsart des Wechselrichters kann jederzeit vom Anlagenbetreiber durch Setzen eines Softwareparameters definiert oder geändert werden. Bei werkseitiger Auslieferung der Wechselrichter als "Windy Boy" ist der Softwareparameter bereits auf Windgenerator-Betriebsart gesetzt. Zur Kennung dieses Auslieferungszustandes besitzt der Windy Boy folgende Unterscheidungsmerkmale gegenüber dem baugleichen Sunny Boy:

- Deckel mit dem Aufdruck "Windy Boy" anstatt "Sunny Boy".
- Typenschild mit Aufdruck "WB(SB) xxxx" anstatt "SB xxxx".

**Alle Zertifikate der "Sunny Boy" Wechselrichter sind somit auf entsprechende "Windy Boy" Wechselrichter übertragbar.**

**Declaration of the manufacturer concerning the validity of the certificates regarding the "Sunny Boy" inverters with respect to the "Windy Boy" inverters**

The Windy Boy inverters are identical with the according Sunny Boy inverters (see table). Each Sunny Boy inverter can therefore be used as Windy Boy inverter and vice versa. The respective operating mode of the inverter can be set or changed by the operator be means of an according software parameter. The delivery of "Windy Boy" inverters is done with the according setting of the operating mode to "Wind-Turbine Mode". The presetting of this operating mode in the Windy Boy includes:

- Enclosure lid with label "Windy Boy" instead of "Sunny Boy"
- Type label with a type indication "WB(SB) xxx" instead of "SB xxx"

**All certifications of the "Sunny Boy" inverters are therefore also valid for the respective "Windy Boy" inverters.**

**Explicación del fabricante sobre la transferibilidad de los certificados de los inversores "Sunny Boy" a los inversores "Windy Boy".**

Los inversores de la serie "Windy Boy" presentan una construcción absolutamente idéntica con los de la serie "Sunny Boy" (véase tabla). Por lo tanto, todos los inversores "Sunny Boy" se pueden manejar como los "Windy Boy" y viceversa. El usuario del equipo puede, en todo momento, definir o modificar el modo de funcionamiento respectivo configurando un parámetro de Software. Los inversores "Windy Boy" que vienen de fábrica disponen de un parámetro de Software ya configurado para el modo de funcionamiento generador eólico. Para reconocer este estado de entrega de fábrica, el "Windy Boy" presenta respecto al "Sunny Boy", que está construido idénticamente, las siguientes características:

- Tapa donde aparece impreso, en lugar de "Sunny Boy", "Windy Boy".
- Placa de identificación donde aparece impreso, en lugar de "SB xxxx", "WB(SB) xxxx".

**Por las razones expuestas anteriormente, todos los certificados referentes a las características del inversor "Sunny Boy" son transferibles a los correspondientes inversores "Windy Boy".**

WBIDENT-11:BX3506 /1

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SMA

# Windy Boy

**WB 700, WB 1100, WB 1100LV, WB 1700, WB 2500, WB 2800i, WB 3000, WB 3300, WB 3800, WB 5000(A), WB 6000(A)**

**Déclaration du fabricant relative à la transmissibilité des certificats des onduleurs "Sunny Boy" aux onduleurs "Windy Boy"**

Les onduleurs de la série Windy Boy sont, en termes de construction, parfaitement identiques aux onduleurs correspondants Sunny Boy (voir tableau). De cette manière, chaque onduleur Sunny Boy peut être exploité comme un Windy Boy et inversement. L'exploitant de l'installations est donc en mesure de définir ou de modifier le mode de service respectif de l'onduleur en configurant un paramètre du logiciel. Si l'onduleur a été livré avec un réglage usine en tant que "Windy Boy", le paramètre du logiciel est déjà configuré en mode de service générateur éolien. Afin de reconnaître le type de livraison dont il est question, le Windy Boy présente les caractéristiques distinctives suivantes par rapport au Sunny Boy de construction identique:

- sur le couvercle, l'inscription "Windy Boy" remplace "Sunny Boy".
- sur la plaque signalétique, l'inscription "WB(SB) xxxx" remplace "SB xxxx".

**Pour les raisons évoquées précédemment, tous les certificats relatifs aux appareils de la série d'onduleurs "Sunny Boy" sont transmissibles aux onduleurs correspondants "Windy Boy".**

**Dichiarazione del produttore sulla trasferibilità delle certificazioni per inverter "Sunny Boy" rispetto agli inverter "Windy Boy".**

Gli inverter della serie Windy Boy sono di costruzione assolutamente identica rispetto al corrispondente inverter Sunny Boy (vedi tab). Ogni inverter Sunny Boy può quindi essere utilizzato come Windy Boy e inversamente. Il modo di funzionamento dell'inverter può essere definito o modificato di volta in volta dal gestore dell'impianto impostando un parametro del software. In caso di fornitura dell'inverter da parte del costruttore come "Windy Boy", il parametro del software viene preimpostato di fabbrica sul modo di funzionamento generatore eolico. Ai fini dell'identificazione di tale configurazione al momento della consegna, il Windy Boy presenta le seguenti caratteristiche distintive rispetto al Sunny Boy di costruzione identica:

- coperchio con la scritta "Windy Boy" invece di "Sunny Boy".
- targhetta con la scritta "WB(SB) xxxx" invece di "SB xxxx".

**In virtù ai motivi suddetti, tutte le certificazioni relative agli inverter "Sunny Boy" sono trasferibili sui corrispondenti inverter "Windy Boy".**

Niestetal, 28.08.2006

**SMA** Technologie AG

i.V. Frank Greizer

i.V. Frank Greizer
(Entwicklungsleiter Solartechnik / Head of Development Department Solar Technology)

| **Sunny Boy** | | **Windy Boy** |
|---|---|---|
| SB 700 | = | WB 700 |
| SB 1100 | = | WB 1100 |
| SB 1100LV | = | WB 1100LV |
| SB 1700 | = | WB 1700 |
| SB 2500 | = | WB 2500 |
| SB 2800i | = | WB 2800i |
| SB 3000 | = | WB 3000 |
| SB 3300 | = | WB 3300 |
| SB 3800 | = | WB 3800 |
| SMC 5000(A) | = | WB 5000(A) |
| SMC 6000(A) | = | WB 6000(A) |

WBIDENT-11:BX3506 /2

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## 10.4 Clean report of findings

The Windy Boy is equipped with the "SMA grid guard 2" automatic disconnection device and is covered by the industrial trade association "SMA grid guard, version 2" clean report of findings.

Fachausschuss Elektrotechnik
der Berufsgenossenschaftlichen Zentrale
für Sicherheit und Gesundheit – BGZ
des Hauptverbandes der gewerblichen Berufsgenossenschaften

BG
Federführung:
Berufsgenossenschaft
der Feinmechanik
und Elektrotechnik

Fachausschuss Elektrotechnik, Postfach 51 05 80, 50941 Köln

SMA Technologie AG
Hannoversche Straße 1-5
34266 Niestetal

| Ihre Zeichen/Nachricht vom | Unser Zeichen (Bitte stets angeben) | Bearbeiter | ☎ (02 21) 37 78 | Datum |
|---|---|---|---|---|
| | UB.010.17 | PI/Ow | 6312 | 25.01.2006 |

**Unbedenklichkeitsbescheinigung**

**Erzeugnis:** Selbsttätig wirkende Schaltstelle (ENS)

**Typ:** SMA grid guard
Version 2

**Bestimmungsgemäße Verwendung:** Selbsttätig wirkende, dem VNB unzugängliche Schaltstelle als Sicherheitsschnittstelle zwischen einer Eigenerzeugungsanlage und dem Niederspannungsnetz. Gleichwertiger Ersatz für eine jederzeit dem VNB zugängliche Schaltstelle mit Trennfunktion.

**Prüfgrundlage:**

DIN V VDE V 0126-1-1 (2006-02) "Selbsttätige Schaltstelle zwischen einer netzparallelen Erzeugungsanlage und dem öffentlichen Niederspannungsnetz"

Das Sicherheitskonzept des o.g. Erzeugnisses, entspricht den zum Zeitpunkt der Ausstellung dieser Bescheinigung geltenden sicherheitstechnischen Anforderungen für die aufgeführte bestimmungsgemäße Verwendung.

Die Unbedenklichkeitsbescheinigung wird spätestens

**31.12.2010**

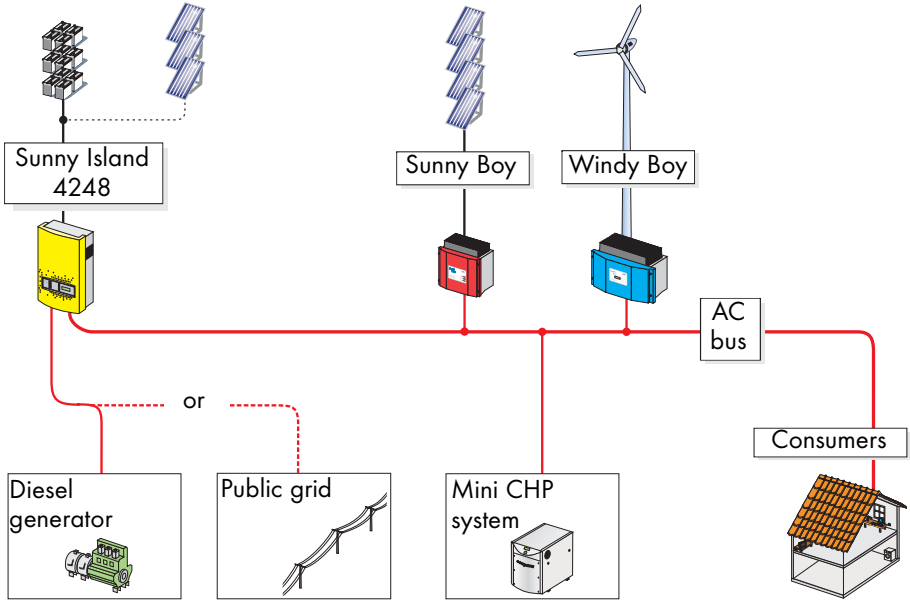
ungültig.

- Mehlem -
Leiter der Prüf- und Zertifizierungsstelle

Hausadresse: Gustav-Heinemann-Ufer 130 50968 Köln Tel. (02 21) 37 78-63 01 Fax (02 21) 37 78-63 22

# 11 Stand-Alone Systems

The Windy Boy is suitable for use in stand-alone systems based on the Sunny Island. For this purpose, the Windy Boy requires extra settings to ensure optimal operation and to deactivate the standard grid monitoring settings. Refer to the Sunny Island manual for all further relevant information.



# 12 Contact

If you have any questions concerning the Windy Boy, or any technical problems, contact our service hotline. Have the following information available when you contact SMA:

- Inverter type
- Type of wind turbine and AC/DC converter
- Type of overvoltage protection
- Communication
- Serial number of the Windy Boy
- Inverter's blink code or display

**Address:**
**SMA** Technologie AG
Hannoversche Strasse 1 - 5
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Germany
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hotline@SMA.de
www.SMA.de

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- Operating the product in an unintended environment
- Operating the product whilst ignoring relevant, statutory safety regulations in the deployment location
- Ignoring safety warnings and instructions contained in all documents relevant to the product
- Operating the product under incorrect safety or protection conditions
- Altering the product or supplied software without authority
- The product malfunctions due to operating attached or neighboring devices beyond statutory limit values
- In case of unforeseen calamity or force majeure

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